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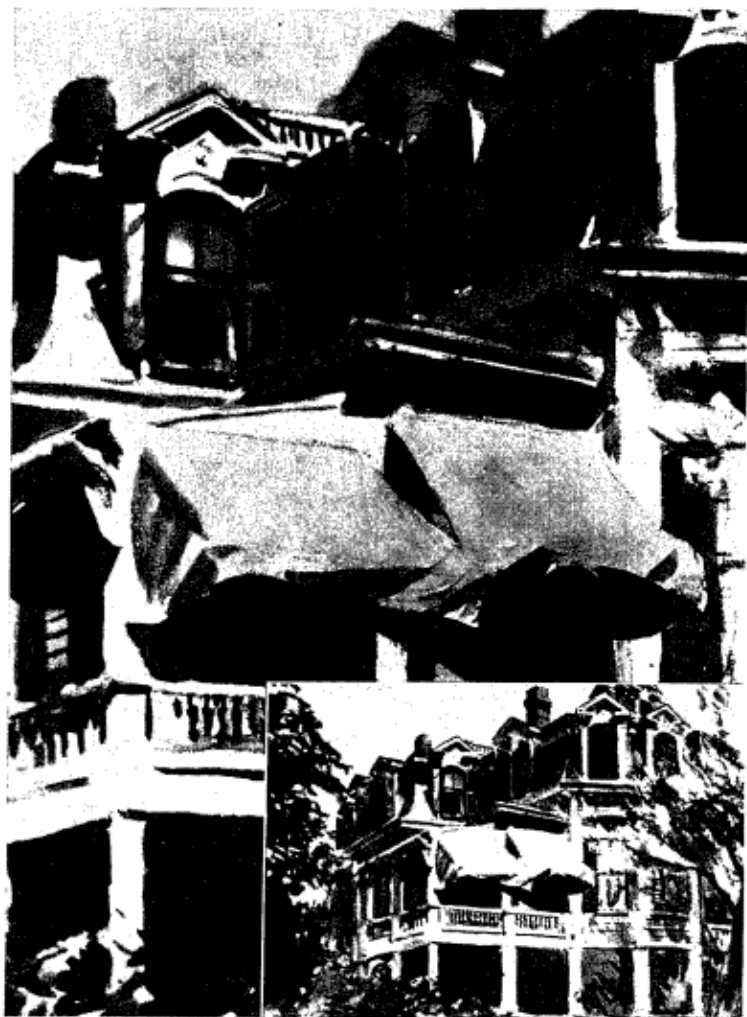
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E D U C A T I O N O F F I C E  
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# THE MANSARD ROOF

By Edward Hopper

Over the flat washes the artist has placed his shadows and details. The white of the paper forms the whites and highlights.

Brooklyn Museum Collection

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## FOREWORD

ON THE ASSUMPTION that nobody reads a foreword anyway, and that certainly nobody wants to write one, it would seem logical to omit this literary stepchild altogether. But the present handbook, being a collection of articles by various authorities with widely differing views, seems also to need a few coordinating remarks at the outset, not to mention the fact that some justification ought to be put forward for a publication which duplicates in part the many scholarly treatises on techniques mentioned in the bibliography.

On January 31, 1936, to start at the beginning, the Brooklyn Museum opened an exhibition of contemporary materials and techniques in the fine arts. This was designed to answer two very common questions, first, how are works of art made, and second, to what extent do the raw materials and the technique of the artist determine the form of the finished piece? There had been many exhibitions of methods and processes before, particularly in the graphic arts, but none that I know of, which covered all branches in a concise and comprehensive manner. The same reason lies behind the publication of this handbook, which was prepared in conjunction with the above exhibition and draws many of its illustrations from material shown at that time.

I hope that the first question, how works of art are made, has

been clearly answered in these pages, and that no one still believes that the artist creates in vacuo with no thought for his medium or the methods of treating it, which are at his disposal. That is a pretty thoroughly exploded romantic myth in any case, a windmill hardly worth tilting at.

The question of the influence of raw material and technique on the finished work of art is more complex and much more interesting. The modern trend, as most of the following articles show, is towards an esthetics based on functionalism. Contemporary architecture strives to express both the nature of the structural materials and the human uses for which the building is designed. The woodcut utilizes angular forms based on the technique of cutting the blocks. Stone sculpture preserves portions of the untouched rock from which the finished piece was carved and shows intentionally the marks of the chisel, the point and the bush hammer. Bronze sculpture is worked out in terms of smooth, metallic surfaces, often highly polished. So one might go on through most of the branches in contemporary art.

This present day tendency is a revolt from the romantic values which dominated art from the XVIIth through the XIXth centuries. There was, of course, no lack of skilled technique during this period, but it was employed primarily to create pictorial values in all the arts regardless of the nature of the medium. Painting was the dominant force; it set the pace while stone sculpture, bronze, architecture and the rest aped its effects as closely as possible. The result, of course, was an almost total divorce between material, technique and style, except in the case of painting.

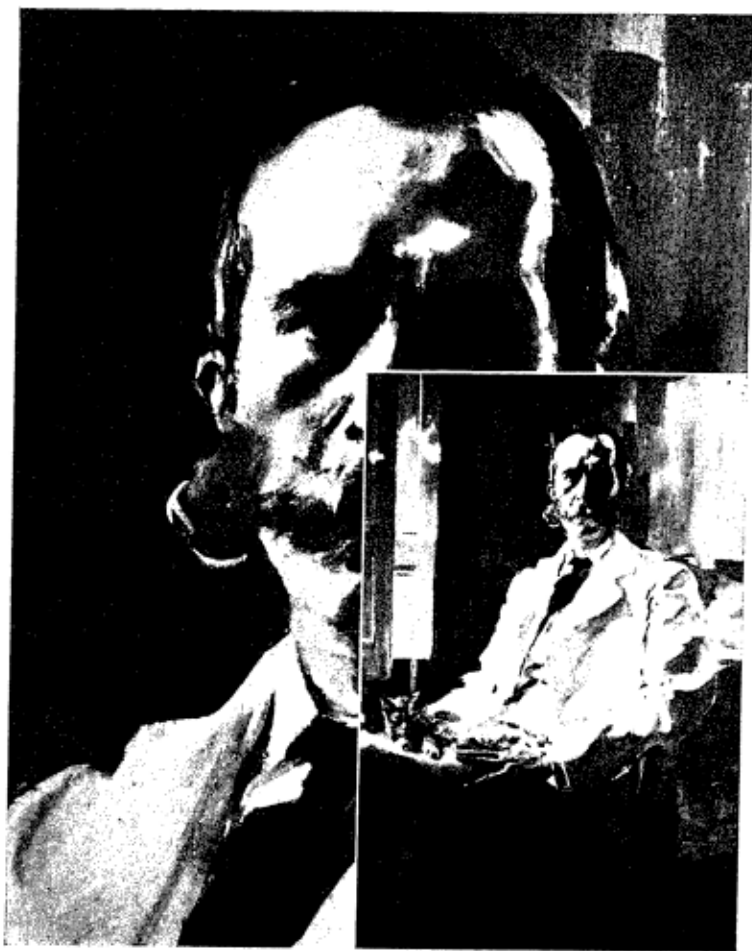
But with the contemporary reaction — the return to functional design — the materials and techniques of the artist have played an increasingly important part in determining the form which his finished work will take. It follows, therefore, that to understand fully the nature of this new art, it is necessary to know something of

these raw materials which the artist uses and of the processes by which he brings out their inherent qualities. It is largely for this purpose that the present handbook was published, not merely to answer the question of how art is made, but also to indicate, at least, the why and the what of it.

Finally, the Museum makes grateful acknowledgment to the many artists, galleries, museums, private individuals, and commercial firms whose loans of material made the exhibition possible and provided the illustrative material for this publication. The list is too long to be given here, but special acknowledgment is due to those who wrote the following articles and to the Encyclopaedia Britannica for its kind permission to reprint the article on Bronze Sculpture.

JOHN I. H. BAUR





MAN IN WHITE

By Cecilia Beaux

The sweeping stroke of the brush follows the contours of the form.

Brooklyn Museum Collection

## PAINTING

By Sheldon Keck

Restorer, Brooklyn Museum

OIL • In his life of Antonello da Messina, Giorgio Vasari\* tells us that oil painting was invented by Giovanni da Bruggia (Jan Van Eyck), a Flemish painter of the early XVth Century. On the strength of Vasari's statement, the origin of oil painting has for centuries been attributed to Jan Van Eyck and his brother Hubert.

In recent times this tradition has been successfully refuted. Laurie, Church, Eastlake and other scholars have published old receipts and Cathedral records from England, France, Germany and Flanders. These writings offer evidence which places the beginnings of oil painting several hundred years earlier than the time of Jan Van Eyck. The use of linseed oil as a medium is mentioned in the XIth Century treatise of Theophilus as well as in the later treatises of Eraclius and Cennini.

Although the Van Eyck brothers are no longer credited with the invention of painting in oil, there is no question that it was they who brought it to perfection. The extraordinary success with which they painted in oil was instrumental in causing this medium to supersede the older mediums of tempera and fresco. During the five centuries which have passed since their time, oil painting has not

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\* Giorgio Vasari (1511-1574): "Lives of the Most Eminent Painters, Sculptors and Architects."

only become increasingly popular among painters but has also undergone many changes in handling and in use.

Paint consists of a dry pigment, ground in an appropriate liquid vehicle or medium. The pigment gives body (thickness) and color, while the medium carries the pigment in suspension and on drying, acts as a binder. In oil painting, the medium used is called a drying oil. Drying oils such as linseed oil, walnut oil or poppy oil, oxidize on contact with air to form a tough, flexible film.

"Under certain circumstances," writes Church\* "it (the drying oil) absorbs oxygen to the extent of thirteen or even fourteen percent of its weight, becoming converted into a mixture of substances for which it is convenient to retain the old name of linoxine. Linoxine is solid and not liquid: it is far less soluble than linseed oil in any solvent, and in many liquids insoluble."

This process of oxidation of the drying oil is much less rapid than the drying, by evaporation, of moisture in watercolor painting. An oil painting may be dry to the touch in twenty-four hours but the oxidation process continues for several years.

Linseed oil, the first drying oil used by painters, is extracted from the seed of cultivated flax. It is obtained for use in painting either by pressing the heated seed or by the application of pressure on the cold seed. The resulting oil in the latter method is preferable for artistic use as it is much clearer and more fluid. Pressing the heated seeds yields a larger amount of oil but the oil contains more impurities in the form of mucilaginous matter. Both cold and hot pressed oil may be further purified by filtration, washing with salt and water, by chemical treatment or by allowing the oil to stand. Driers or siccative substances are often added to linseed oil to increase its rate of hardening. These substances — lead, man-

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\*A. H. Church, "The Chemistry of Paints and Painting," Seeley & Co., Ltd., London, 1901.

ganese, cobalt compounds or resinous mixtures — are dangerous to the permanence of the painting unless used sparingly.

Nut oil, obtained from the common walnut, followed linseed oil in early use as a paint medium. Leonardo da Vinci in his treatise on painting, recommends it as a varnish medium. Cold pressed nut oil is very pale in color.

Poppy oil was introduced into painting after linseed and nut oil, in the beginning of the XVIIth Century. It is a pale, slow drying oil, obtained from the seed of the opium poppy. Because of its slow drying character, tube colors are often ground in it to allow longer periods of storage than linseed oil, which will often harden in the tube.

The pigment which is ground in the oil may be of organic or inorganic origin. The earliest pigments had their origin in the different colored earths and minerals (inorganic) and in dyes extracted from plants (organic). Such colors as natural vermilion, yellow ochre, terre verte, malachite green, azurite blue, ultramarine and venetian red are found in their native state in the earth and need only grinding to be used in painting. Most of these natural mineral pigments are extremely permanent and are used by the painters of today as much as they were used by the painters of ancient Egypt, China, Greece and Rome.

The advances of science in the XIXth and XXth Centuries added considerably to the painter's palette. Most of the aniline colors derived from coal tar are too fugitive for the painter's use and should be avoided. Alizarin, however, though also a coal tar product, is more permanent than its historic counterpart — the fugitive madder lake, derived from the root of the European madder plant. The chemist has added such inorganic and permanent pigments as the cadmium reds, oranges and yellows, oxide of chromium greens,

artificial ultramarine, zinc white, cobalt blues and yellows and zinc yellow.

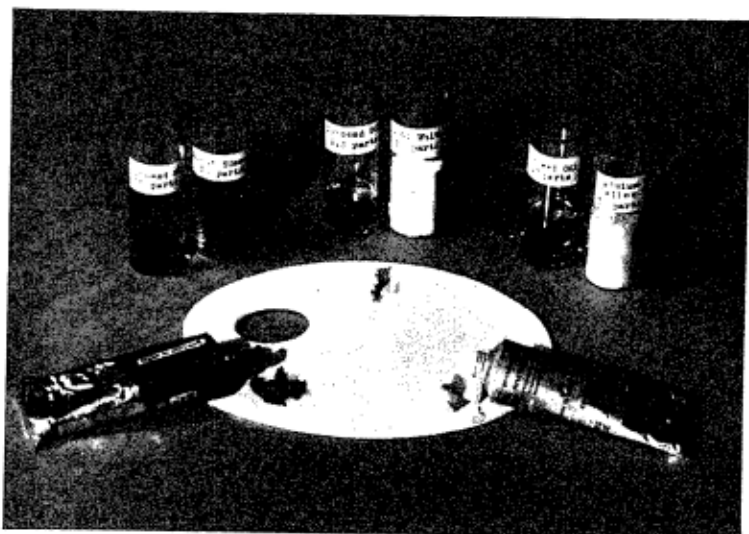
"The objection of many painters to the use of any chemically manufactured pigments, which arises from the belief that all unpleasant changes in pictures are to be ascribed to them, is unwarranted. On the contrary, these pigments can always be reproduced to possess the same quality and purity, whereas the much praised earth colors such as ochre, are often impure and varying in the composition, as are incidentally all natural products. It is often heard said among artists that the old masters had no 'chemical' pigments, and for that reason their pictures are so well preserved. This, however, is a misconception, for the old masters had white lead, Naples yellow, vermillion, copper and sulphur colors, etc. The reason for the greater permanency of many of the older pictures lies in the fact that they were built up in a correct and craftsman-like manner." \*

The painter of the past ground his pigments in the medium to suit his own taste and consequently knew the quality of the ingredients he used. Today the painter buys his colors already ground and in tubes. The more progressive manufacturers label the entire ingredients of each tube.

In easel painting, oil paint is placed on a support which must for convenience be light, durable and easily transportable. Although in the past various materials have been used, the most generally accepted is canvas of linen, hemp, cotton or jute, stretched on a wooden framework. The weave of the canvas is sometimes important to the painter in producing an effect. The material may be obtained in various weights, from a smooth closely-woven canvas to one of coarse, heavy grain. Cotton canvas tends to stretch after

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\* Max Doerner: "The Materials of the Artist and Their Use in Painting," translated by Eugen Neuhaus; Harcourt, Brace & Co., New York, 1934.

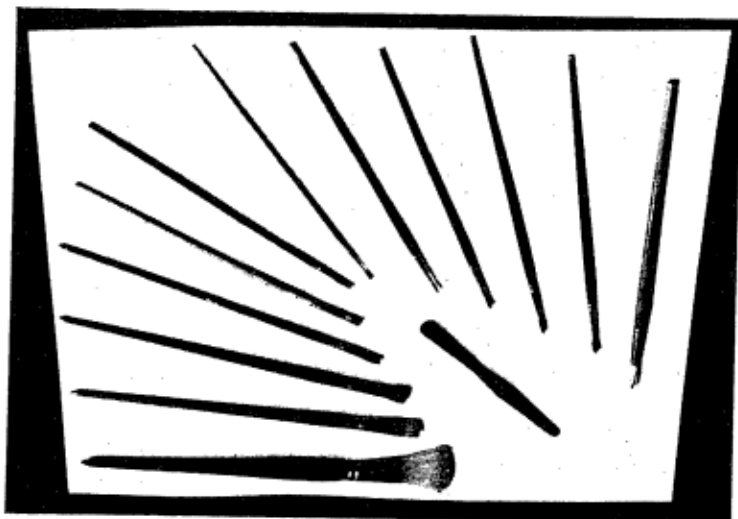


#### CONTENT OF THREE MIXED PAINTS

This photo shows the pigment and linseed oil content of three mixed paints, cadmium yellow, zinc white and burnt sienna.

painting. Linen does not and has the reputation for being more durable, but durability depends on atmospheric and other conditions. Hemp and jute have a coarse open weave and take a heavy ground, but are suitable for large paintings where the coarse texture does not interfere with the effect intended. Oil paintings have been made on panels of wood, on sheets of metal, and slabs of stone — usually slate, but limited in size and by excessive weight these supports are neither popular nor practical. However, some of the modern wall boards and plastic materials are coming more and more into favor as strong, light supports for painting in oil.

The support of linen or board must be prepared for painting. Since acidity in linseed oil rots linen and also because of the poros-

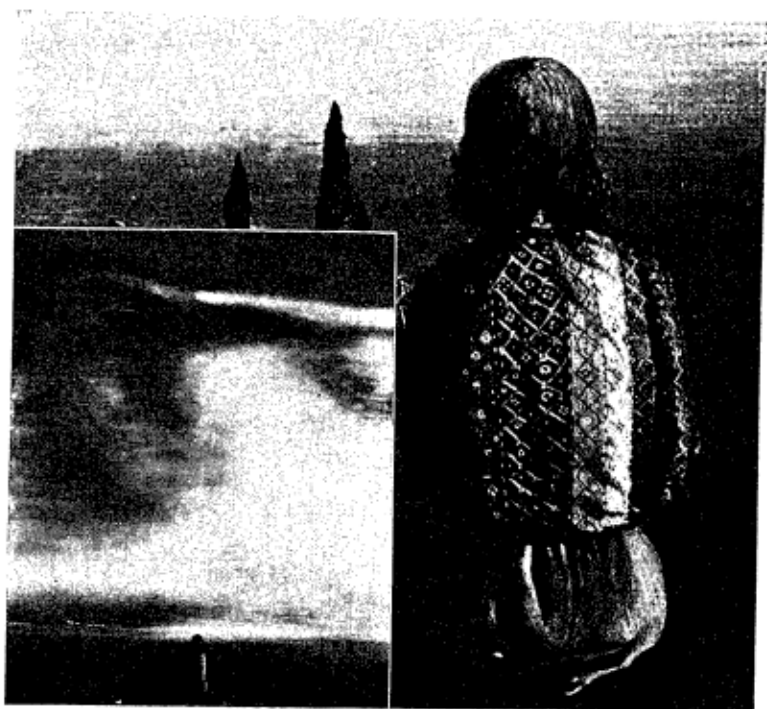


#### BRUSHES AND PALETTE KNIFE

These are the painters' tools for the application of oil paint.

ity of the material it is necessary to dress the canvas with some insulating material. This dressing merely consists of a thin coating of size (gelatin, glue or casein). In order to give the painter the surface texture and ground color upon which he wishes to work, the linen may be further prepared by being primed with a filler. This priming does two things; it tends to hide the weave and it gives it greater body at the same time. Some painters prefer to work directly on the dressed canvas, feeling that further priming increases the danger of cracking in the picture.

More commonly, the sized linen is covered with a priming containing size and a filler of finely ground chalk, gypsum or zinc white. The Italian masters made their priming of gesso, a mixture of whitening or plaster of Paris and size. Later they introduced red and



# SUGAR SPHINX

By Salvador Dalí

Thin impasto allows the introduction of microscopic detail.

Collection of Mrs. Joseph J. O'Donohue III

brown clays into the mixture as ground colors on which to paint. Doener's chalk ground of equal parts gypsum, zinc white and a glue solution of 70:1000 parts glue and water, gives a very white rather absorbent ground. Less absorbent grounds are made by the addition of linseed oil or varnish.

The prepared canvases sold at artists' supply stores usually contain oil or chalk grounds, to which honey, glycerine, castor oil,





#### DRESSING ROOM

By Walt Kuhn

The paint is applied in a very thin impasto in the darks. The whites show a partial loading of the paint.

Brooklyn Museum Collection

syrup or some plasticizer is added to keep the canvas pliable and easily rolled. The addition of such materials often causes discoloration and attracts bacteria and mould growths.

The technique of applying the paint to the canvas is personal to the painter. He has for his tools brushes of various sizes, shapes and degrees of stiffness, and the palette knife. By means of these, he may apply the paint to the best advantage for the result he



PANSY

By Georgia O'Keeffe

An even gradation of tone is obtained by a smooth application of the paint.  
Brooklyn Museum Collection

requires. He has also for his use such diluents as turpentine and benzine or, if he prefers, he may add more oil to thin out his stiffly ground paints. With a soft brush of sable hair and paint thinned with turpentine an artist may achieve a very smooth, wash-like effect similar to that attained in watercolor. The depth of the paint film is termed impasto and may be thin, heavy, uneven or even.

Salvador Dali's "Sugar Sphinx" shows an extremely thin and even

application of paint with no brush work apparent. It is possible by this method to introduce in a picture great detail and a high degree of finish. Such, however, is not necessarily the end in view in a painting of thin impasto.

Walt Kuhn's "Dressing Room" illustrates a use of low impasto quite different from that of Dali. Kuhn's handling in this painting ranges from a thin wash of diluted paint in his blacks and greys to a partial loading of his whites. The texture of the primed linen is apparent everywhere except in the white.

The amount of diluent used controls to a large extent the thickness of the paint. With this control and the personal method of application, it is possible to obtain a wide gamut of purely textural effects running from low to very high impasto.

Georgia O'Keefe's "Pansy" shows a very even application of paint on a finely woven canvas, the texture of which is difficult to see. This smooth method allows for fine gradations of color intimately mixed. The direct painting of George Bellows' "Sand Cart," in the Brooklyn Museum Collection, shows the use of a bristle brush with a medium impasto. The texture is much less even than that of the O'Keefe, but Bellows has the advantage of putting down directly what he views without reworking or smoothing his painting. His work is similar in this technique to that of the Impressionists.

"The Man in White," by Cecilia Beaux, also painted directly and with great bravura, shows a long sure stroke with loaded brush, usually following the contours of the form.

Segonzac uses a heavy, uneven impasto in his "Still Life in Garden." A comparison of the surface qualities of the Dali and Segonzac indicates the wide range of textures possible to the painter.

The use of the palette knife for painting is often considered a



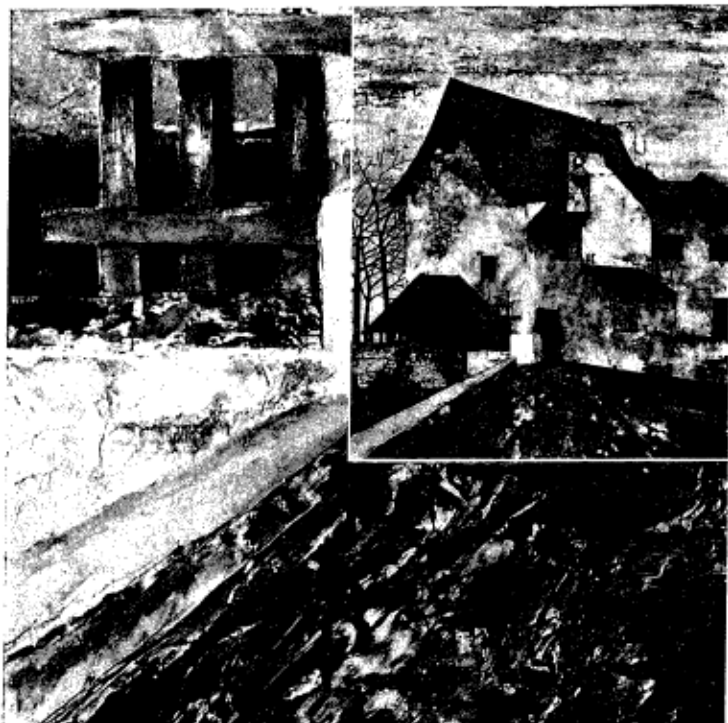
STILL LIFE IN GARDEN

By André de Segonzac

A heavy impasto gives surface texture to the paint film.

Collection of Mr. Frank Crowninshield

technical tour de force. The paint is applied directly from the palette to the canvas by means of the knife. The colors may, of course, be mixed on the palette to obtain the tone required. "Ferme, Bearnaise," by Josselin Bodley, shows the use of a palette knife throughout. In this painting one may see a very thin impasto showing the texture of the canvas where the palette knife was used to scrape off an excess of paint. In some portions, loading of the paint with a rough texture resulting, can be noticed, while in other



FERME, BEARNAISE

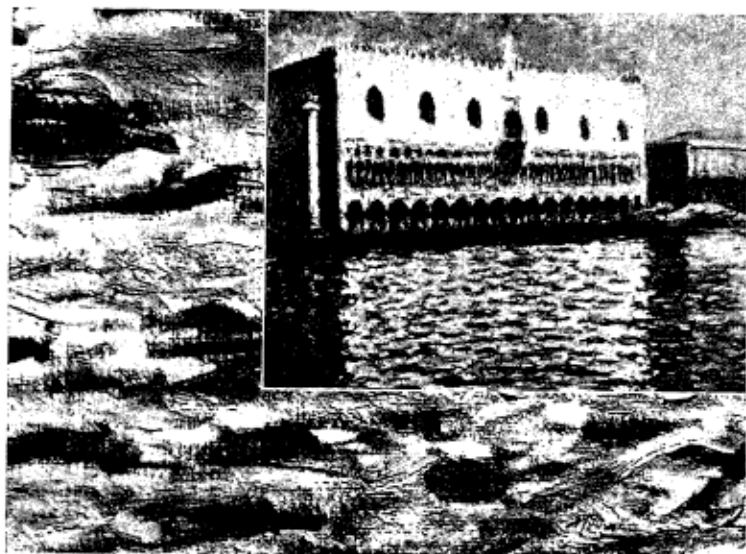
By Josselin Bodley

This painting is rendered throughout with the palette knife.

Brooklyn Museum Collection

portions a very smooth surface is obtained with the flat side of the knife. The method of applying paint with a palette knife is quite different in appearance from brush work. It is often used in conjunction with the brush in the same painting, as in Segonzac's "Still Life in Garden," where the effect of contrast in handling is desired.

Purely textural results are not the chief technical aim of the



PALACE OF THE DOGE, VENICE

By Claude Monet

Individual strokes of pure color increase the freshness and luminosity of the painting.

Brooklyn Museum Collection

painter in his application of paint. He is interested in color and tone relations as an aid in producing his result. The Impressionists in the XIXth Century influenced by the studies of color scientists and theorists, adopted a method of color division in painting. Instead of mixing their paints, they laid them on in thin strokes of pure color. At a distance, producing optical fusion, these strokes blended to effect the fresh, vibrant appearance of daylight. When two brilliant colors are mixed, the resulting third color is always less intense than either of the originals; on the other hand, when the same two colors are juxtaposed in thin strokes, the third color formed by their optical fusion is purer and more luminous than could otherwise be obtained.

"The Palace of the Doge, Venice" is a representative example of this technique by its great protagonist, Claude Monet. In this painting the juxtaposition of single brush strokes of different colors may be seen clearly. There is also a slight mixing of the colors themselves on the canvas where the strokes run into each other. This rather unsystematic type of broken color was succeeded by the methodical work of the Neo-impressionists. Monet's application of brush strokes in the direction of the plane and his attempts to reproduce the texture of material were entirely dropped. Instead appeared minute, equal dots, regular and unloaded. This method was known as Pointillism. Neo-impressionists such as Paul Signac and Georges Seurat carried chromatic principles to this logical conclusion.

The technique of Indirect Painting, which combines underpainting, glazing and scumbling, was used with success by the great Venetian masters of the Renaissance. It is also used by some of our present day painters. A glaze takes the form of a thin transparent film of color superimposed on another color to modify the tone or to enhance its effect. The undertone appears through the glaze which is often darker than the color upon which it is laid. Scumbling, on the other hand, is usually achieved by going over the work with a stiff brush containing very little paint, the tone of which is opaque and often produced by admixture with white. The brush is drawn somewhat loosely over the previous painting, which must be dry and firm.

There are many variations in the use of glazing and scumbling, but the older method as used by Titian, Tintoretto, Veronese, and the Venetians, consisted of an underpainting in monochrome which gave the entire modeling of the form, over which the local colors were glazed in thin transparent washes of paint in an oil or varnish medium. Scumbling was often used in conjunction to soften tones



SHOPPER (Detail)

By Kenneth Hayes Miller

This picture is painted in the indirect method of underpainting, glazing and scumbling.

Courtesy of the Whitney Museum of American Art

and add greater atmospheric depth to the painting. The indirect method as used today, is well illustrated in the "Shopper" by Kenneth Hayes Miller. The underpainting is rendered in monochrome — probably a mixture of red, black and white. When the monochrome underpainting is dry, the local color is overlaid in a series of glazes. Scumblings of white are next applied, picking out



the highlights which, in turn, are reglazed with less color. Depth of tone and richness of color are obtained in this way.

When a painting is sufficiently dry, usually a year after it has been completed, it is varnished. Varnishing too soon is likely to produce cracking in the paint film. Varnish protects the surface of the painting from deterioration caused by dirt, humidity and deleterious gases in the atmosphere. A picture varnish must be able to preserve the brilliancy of the colors and guard them against chemical action of moisture and injurious gases. It must be as colorless and transparent as possible and also should be easily removable since all varnishes darken in time and accumulate grease and dirt.

Varnishes which are composed of a resin\* dissolved in a medium or solvent, consist of two types, namely oil varnishes and spirit varnishes. Oil varnish consists of a resin dissolved by heat in a drying oil. Because of its slow drying character and the difficulty of removing it, this type of varnish has practically gone out of use, except as an occasional painting medium with which oil colors are mixed. Spirit varnishes are those in which the resin is dissolved in a volatile solvent. They dry quickly by evaporation of the solvent, leaving an even resin film over the surface of the picture. If a soft resin such as mastic or damar has been used the varnish is easily removable. Since pure resin varnishes have a very high gloss, wax or the palmitate or stearate of aluminum may be added to them. When applied to the surface of the paintings this mixture dries with a dull, matte finish.

Further protection may be given to the surface of a picture by applying beeswax or a mixture of waxes dissolved in turpentine to the already varnished painting. Wax is exceedingly impermeable

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\* Resins like Sandarac, Damar, Mastic and Manila Copal are obtained from various trees, while others such as Kauri and Congo Copals and Amber are found in semi-fossil or fossil state.

to moisture and gases and may be removed at will with turpentine or benzine.

**WATER COLOR** • In water color painting, the medium used consists entirely of aqueous solutions. The usual binding material for the pigment is gum. Gum arabic, a product of the acacia tree, was used by the Egyptians, although the technique which they employed was quite different from our present conception of water color painting. The painters of China, Persia and India, as well as the European illuminators, all used a type of water color in their painting. At about the time of the Middle Ages in Europe, the fluid treatment of the medium, most popular today, was highly developed by Oriental painters whose preference for a direct brushwork on silk had necessitated an economy of effort and a certainty of touch in the use of water color. As a result, Oriental watercolorists are renowned for the remarkable dexterity of their handling.

In Europe, from the time of the Renaissance on, water color was used in pen and wash drawings. It did not, however, begin to develop as an art in itself until its possibilities were realized by the English artists of the XVIIIth Century. From the time of Cotman, Turner, Girtin and Blake, it has been treated as a distinct and separate medium from which many different schools of water color have arisen.

Gum, the binding medium in water color, is of vegetable origin and is soluble in cold water. Gum arabic, the one most frequently used, exudes from different plant types of the acacia tree found in Northern Africa, Senegal and the Sudan. Other water solubles such as gum tragacanth, dextrin, fish glue and egg white are occasionally used in water color.

Glycerin and sugar of honey (laevulose) added to the medium in

small amounts, keep the color moist and in easily workable condition. These also act as plasticizers to prevent cracking of the paint film. A thirty percent solution of gum arabic in water, to which about five percent of glycerin is added, makes a good medium in which to grind dry pigments. This yields a water color which is easily soluble without having to be worked much with the brush. Because the nature of the medium does not lock up the color as firmly as oil or tempera, only pigments of the most permanent structure should be used, since fugitive or chemically active pigments quickly fade or change color. In order to prevent colors which have been mixed together from separating, particularly when greatly diluted with water, the pigments in water color should be very finely ground. As the task is very difficult, it is not advisable for the artist to prepare his own water colors. Those prepared by manufacturers are sold in cakes, porcelain pans, or put up moist in tubes.

Although parchment, silk and ivory may be used, the commonest support and ground for water color is paper. The paper should be white or very light in color since pure water color is applied in thin layers of transparent nature and depends for its effect and luminosity, upon the ground on which it is executed. Paper made of linen is preferable because it is strong, tough and unchangeable in color. It also takes water very well. Papers of cotton, mulberry and wood pulp may be used, but wood pulp paper is usually poorly sized, it darkens, becomes brittle, and will not stand sponging or scraping. The acid in wood pulp paper reacts with some pigments, altering their color.

Color holds best on paper with a grained texture. In cases where the paper used has been manufactured without sufficient glue in its structure, it is advisable to size the surface with a thin gelatin solution as otherwise the paint may run when applied. Where there

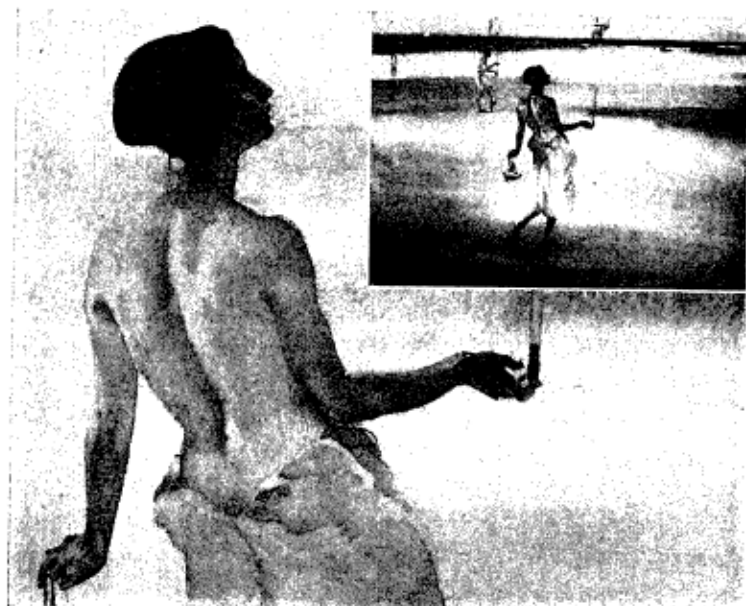
is any grease on the paper, the paint will not adhere to the surface. Water color paper should be kept flat in folios since any creases in the support make the transparent washes appear uneven and the pigments adhere poorly.

The surface of the support on which a water color is to be painted must be stationary. If loose sheets of paper are used, they should be tacked to a drawing board or else mounted on a stretcher. Convenient for the artist and more or less obviating the trouble of mounting, are the water color paper blocks or pads put out by manufacturers. Since paper on the block bubbles when wet, artists often prefer to stretch and mount.

The brush used by the painter is very important in determining the quality of his water color. The hairs of the typical water color brush should form a point which will not divide when used. The best brushes of this type are made of sable, although flat-bristle brushes, broad-wash brushes and camel's hair brushes are used for special purposes. The most accurate palettes for water color, are white enamelware, since they enable a painter to mix his glazes on a surface comparable to his white painting ground.

Water color dries by evaporation of the water content of the paint film and depends for its drying rate largely upon the relative humidity of the atmosphere. In dry weather evaporation is rapid; in damp weather it is slow. Water color always dries lighter than it appears when wet and this change of tone in drying must be taken into consideration by the painter. This effect, however, is comparatively slight.

Water color paint may be laid on the surface of the paper in various ways. Large areas of flat or modulated tone are applied in washes with a large brush fully charged with water and color. Technical skill and practice are necessary in laying an even or graduated wash, a splendid example of which may be seen in



# IDLE SHRIMPERS

By Russell Flint

A graduated wash is used in the background. The possibilities of detailed handling in water color may be seen in the rendering of the figure.

Brooklyn Museum Collection

Russell Flint's painting of the shore and sea in his "Idle Shrimpers." His subtlety of handling produces both luminosity and atmosphere.

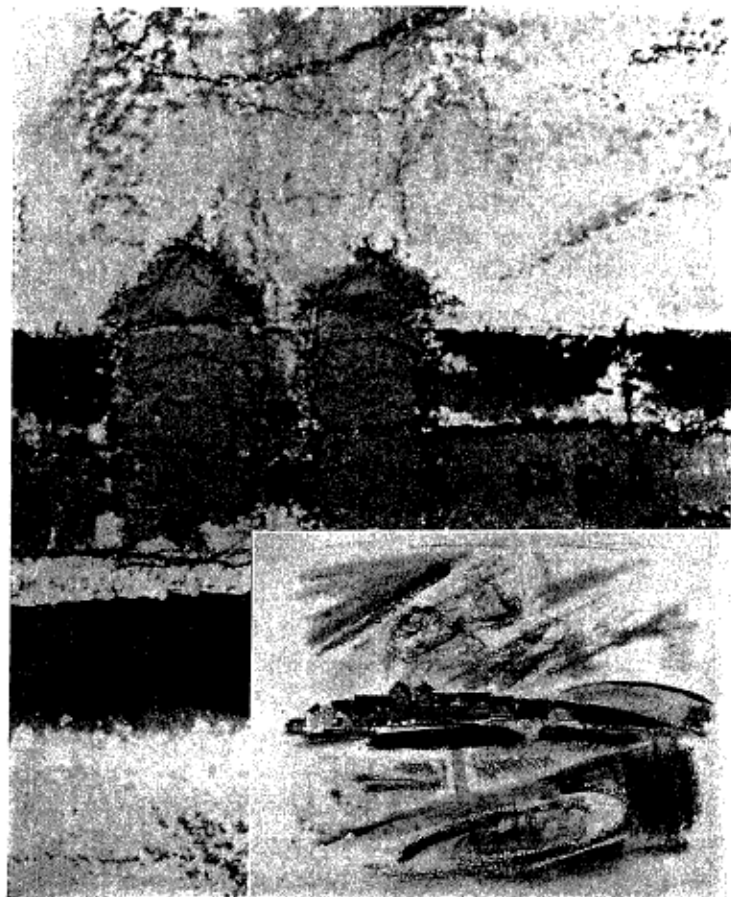
Granulated textures in the color surface itself may be obtained by careful manipulation of the wash. While the wash is thoroughly wet, the paper is tilted back and forth at angles of about sixty degrees, until the pigment settles out into solid spots. This granulation may also be seen in the background of Flint's "Idle Shrimpers."

In modern practice, pure water color is transparent, no Chinese

white being introduced in any of the mixtures. Washes of diluted color are placed on the white paper to produce the tints. Where the artist wishes a white tone or high light, the paper is left uncovered. Dark detail may be applied over a lighter wash, completely covering the color underneath. The possibility in water color of obscuring a dark tone by placing a lighter color over it is very limited, and when this is required the artist may either remove the dark portion, or cover it with an opaque paint. Since the introduction of opaque color kills the translucence of water color, it is customary to remove or lighten the dark tone by the wet methods of "wiping out" and "sponging," or the dry methods of "scratching out" and erasing with rubber.

In "wiping out," the paint film to be removed is redissolved by flooding it with water, and the color in the solution is drawn off by the application of blotting paper. The tone will be noticeably lighter and continued repetition of the procedure will leave the paper quite white. "Sponging" is accomplished by repeatedly and lightly going over the paint film with a wet sponge. It is necessary to wash the sponge frequently during the process to prevent muddy pigment being rubbed into the paper. In "scratching out" the color is completely removed by scraping the surface with the blade of a knife. This method is more often used as a finishing touch for bringing out high lights. It of course destroys the surface of the paper and prevents further work in the area affected.

The artist of today often uses water color for recording rapid impressions which may range from a detailed representation to an abstract design. A sketch in pencil, pen or chalk crayon is usually executed on the paper before any painting is done. The picture may then be built up in various ways. A series of very liquid washes may be used and superimposed on each other until the general local colors of the subject have been obtained. At this point, with paints



BARN IN THE BERKSHIRES

By John Marin

A dry brush has been used on a paper of rough texture.

Brooklyn Museum Collection

less diluted, the details of form and shadows are introduced and carried as far as the artist desires. This method is illustrated in the painting "The Mansard Roof," by Edward Hopper. The careful pencil sketch is apparent in various parts of the picture. An effect of strong sunlight is obtained by contrasting warm light and cool shade in the preliminary washes. Crisp details and sharp, bluish shadows put on directly over the washes, give accent and form to the finished painting. No white pigment is used in this picture. The washes are thin for paler tones and the paper itself furnishes the strong white accents. This procedure, of painting with washes upon which the details are placed, may be reversed, the details being introduced first and harmonized later by washes of color.\*

Very liquid effects are sometimes achieved by wetting or dampening the entire area of the paper or a limited area before beginning to paint. Painting on a wet ground allows the colors to spread, running into one another. George Schreiber's "Under Brooklyn Bridge," in the Brooklyn Museum's collection, illustrates the use of this method. The opposite effect is obtained by painting on a dry paper with very little water in the brush. Working with a "dry brush" at times resembles scumbling in oil painting and when used on a rough paper as in Marin's "Barn in the Berkshires" creates a broken texture in the paint film. An examination of Eliot O'Hara's "Noon-day Glare," in the Brooklyn Museum's collection, shows the use of the dry brush to produce the effect of strong sunlight reflected from a mirror-like expanse of water.

Paul Signac's "Port of St. Tropez" displays the use of water color by a Neo-impressionist. Pure color is applied in individual strokes over a carefully sketched drawing in pencil. The eye of the spectator fuses and blends the spots of brilliant color with the white of the paper, which is allowed to show through freely. An effect of vibrant light is produced in this way.





PORT OF ST. TROPEZ

By Paul Signac

The careful preliminary sketch in pencil is apparent. Juxtaposition of pure colors is used in this painting.

Brooklyn Museum Collection

The method of painting with opaque water color is known as "gouache." The water colors are rendered opaque by the addition of white fillers like barites or clay and the effect achieved is

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\* George Pearse Ennis recommends this procedure in his book "Making a Water Color." The Studio Limited. London, 1933.



# THE BLACK DONKEY

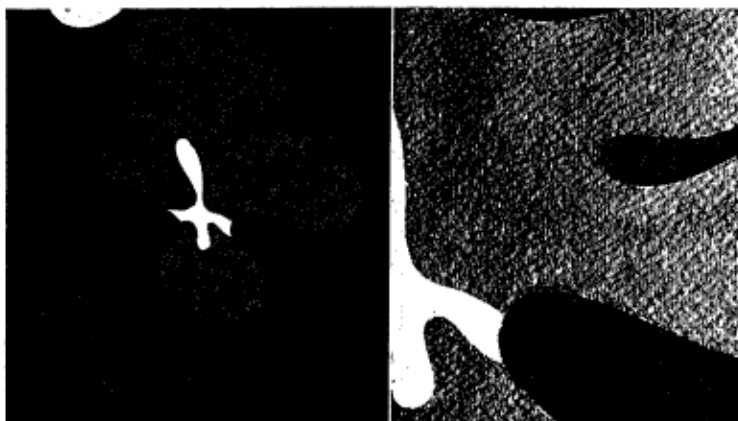
By Edouard Edy-Legrand

The detail shows how an opaque light tone can obscure a darker one in gouache painting.

Brooklyn Museum Collection

that of a pastel done in a wet instead of a dry fashion. In painting, the colors may be mixed freely with Chinese white (zinc white in a gum medium). The high lights and white tones of the picture are executed in white paint instead of using the paper for that color as in pure water color.

"The Black Donkey," by Edy-Legrand, shows a variety of tex-



# ABSTRACT

By Hans Arp

The colors are evenly applied to a rough grained paper.

Courtesy of the Julien Levy Gallery

tures and effects obtainable in a freely handled gouache. The opacity of the paint has permitted him to apply lighter and more brilliant colors over darker and duller tones. This could not have been done with transparent paints.

In gouache the artist is not limited to white or tinted grounds, but may employ extremely dark paper or cardboards for his support. The opaque colors easily cover the dark ground which in some places may be left unpainted as one of the tones of the picture. Gouache is very much lighter after it has dried. It may be handled with extreme fineness of detail, or very freely as in the Edy Legrande painting, and its use in flat pattern may be seen in the even tones of Hans Arp's "Abstract," in which the surface texture is furnished by the grain of the paper.

TEMPERA • The name "tempera" is of Latin origin. In its broadest sense it means any medium used to "temper" dry pig-

ments so that they may be applied and bound to a surface. Thus the term *tempera* may denote any gelatinous or colloidal medium, like oil, egg, or gum, with which pigments are mixed. As it is used today, however, *tempera* signifies only mediums containing egg or glue, the other types being classified as oil, water color and gouache painting. In the following paragraphs the term will be used in its stricter sense, including only egg and its emulsions and glue mediums.

The *tempera* medium has probably been used since man's earliest attempts to represent nature on a two dimensional surface. The Egyptians employed a glue medium in many of their wall and panel paintings. According to Laurie\*, we are safe in assuming that Greek and Roman painters made extensive use of an egg or glue medium, although no definite examples of its use have been found. The first actual reference to *tempera* comes to light in the form of a recipe in a IIIrd or IVth Century papyrus found at Thebes. It directs the use of a medium consisting of egg and gum mixed, with the addition of bile to make the color flow easily.

The painters of Byzantium used the medium for pictures executed on panels, handing on the method to the Italian painters of the XIIIth Century. In Italy during the XIVth and XVth Centuries, *tempera* painting reached a culmination in perfection and general use, only to be replaced by the newer oil medium. The paintings of Giotto, Massaccio, Fra Angelico, Ghirlandaio and Botticelli offer some of the finest examples of *tempera* technique. In Russia, *tempera* painting continued up to modern times as the medium for the ikon painters. It was revived in England in the XIXth Century by the Pre-Raphaelites and is now employed with increasing popularity both in England and the United States.

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\* A. P. Laurie, "Materials of the Painter's Craft," T. N. Foulis, London, 1910.

Although the manuscripts of Theophilus and other medieval painters describe the medium, it is to Cennino Cennini\* that modern tempera painters are indebted for a complete description of the materials and technique of tempera painting. Cennino's medium was composed of egg-yolk. The yolk is separated from the white of the egg, its skin is pierced and the yellow is allowed to run out into a receptacle. To this an equal amount of water is added and thoroughly mixed. On a glass slab, the pigment is ground with this medium by means of an ivory spatula. It may be ground to any consistency desired, but is most often used at about the consistency of heavy cream.

Egg yolk is composed of fifty-one percent water, twenty-two percent fat or oil, three percent mineral matter, fifteen percent albumen and nine percent Lecithin which has many physical properties of a fat but acts as an emulsifying agent for oil and water. Because of the oil content, egg-yolk may be regarded as very closely related to the oil medium. As it dries, the water content evaporates, causing the paint to set quickly. With the lapse of time, the albuminous substances coagulate and become insoluble, and the oil, intimately mingled with the albumen, dries quite slowly, leaving a strong flexible film. Occasionally part of the egg white is used with the yolk as a medium. In this case, the white is separated, beaten and drained, and the liquid which has been drained off is then mixed with the yolk.

The oil content of the egg medium may be increased by the addition of a drying oil or oil varnish, the result being known as an "emulsion medium." In a similar manner a water solution of gum arabic may be added making an egg and gum medium. The

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\* Cennino Cennini, XIVth Century Italian painter, by his own account instructed in the arts by Agnolo Gaddi, son of Taddeo Gaddi, godson and pupil of Giotto. He was the author of a treatise on painting, known as "The Book of the Art of Cennino Cennini."

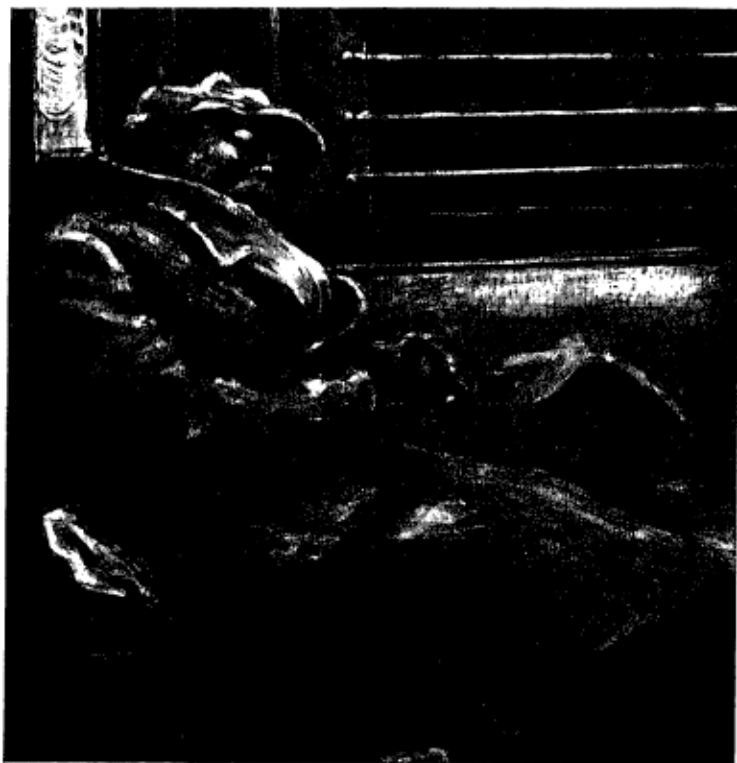
American tempera painters favor these mediums rather than the pure yolk of egg.

Glue and size are very similar substances, containing compounds known as gelatin and chondrin, which soften in cold water and are soluble in hot water. Gelatin is obtained from the skin, tendons, and bones of animals, while chondrin is obtained from cartilage. Glue and size contain no oil, being composed of nitrogenous matter, hence the film formed by them is always soluble unless covered with varnish film. In either a glue or a size medium, preservatives are usually added as both the former putrify in a short time. Plasticizers like glycerine and honey are also added to give a flexible film that will not crack easily.

The support for a tempera painting may be wood, canvas, or some of the modern wall boards. In many cases, cardboard and paper are employed, especially in modern commercial art where glue temperas are largely used.

A priming of gesso on the support is the traditional ground for tempera painting. Gesso is a mixture of whiting and size (or slaked plaster of Paris and size) which yields a dead white, absorbent ground and can be smoothed with abrasives to an ivory-like finish. This type of ground is particularly adapted to tempera painting, since it increases the luminosity and brilliance of the picture. Illustrators' board and tinted drawing papers usually need no priming when used with glue tempera. Since the medium contains no oil, the paint remains opaque and has little tendency toward translucence.

Pigments used in tempera are the same as those used in oil or water color painting. Since the medium is regarded as more permeable to moisture and gases than oil, fugitive and changeable pigments are to be avoided. It is advisable to exclude pigments containing lead and copper, as they may be affected by sulphur



WHY NOT USE THE 'L' (Detail)

By Reginald Marsh

This painting shows the use of a neutral underpainting and superposition of transparent glazes. Courtesy of the Whitney Museum of American Art

present in the albumen constituent of the egg yolk.

Before a painting in tempera is begun, the gesso ground is rendered less absorbent by coating it with a weak solution of size. Because of the peculiarities of the egg medium, it is very difficult to handle it as directly as oil. The design of the picture is usually carefully worked out on a cartoon and transferred to the gesso



# CENTURY OF PROGRESS

By Thomas Benton

Form is obtained by hatched strokes of the brush, a typical handling of the tempera medium. Courtesy of the Walker Galleries, Inc.

ground before painting. The modelling of the relief in form is then rendered in thin washes of black or monochrome. On this foundation, the painting is carried through to completion by glazes of transparent color as well as straight painting in opaque tones.

"Why Not Use the 'L'," by Reginald Marsh, illustrates quite well this method of procedure. The picture is painted on a "Presd-wood"\* panel, primed with gesso, to which the cartoon has been transferred and the underpainting built up in black and white. The superimposed glazes of rich color may be clearly seen and the application of paint throughout is handled very freely. The medium is probably an egg-gum mixture rather than pure yolk of egg.

Thomas Benton's "Century of Progress" is less freely handled

\* A modern composition board made from wood pulp.





FAMILY OF ACROBATS

By Edouard Edy-Legrand

The flower shows the heavy impasto obtainable in glue tempera.

Courtesy of the Marie Sterner Galleries

than the Marsh. A broad hatching stroke models the form of objects and figures, a procedure particularly adaptable to the tempera method. This painting was probably done in a yolk of egg medium.

Much closer to the tradition of the XVth Century tempera painters, are such works as Edward Laning's "Fourteenth Street" and Isabel Bishop's "Combing Her Hair," both in the collection of the Whitney Museum of American Art. The fineness of detail obtainable in tempera painting may be seen in these pictures. Form is modeled by very finely hatched strokes.

Edy-Legrand's "Family of Acrobats" is executed in a glue

medium. The high impasto possible in this kind of tempera may be seen in the flower on the costume of the woman to the left. The opaque quality of the medium as opposed to the translucency of oil, is brought out in this picture. The form is obtained by building up from a dark undertone, the light tones being superimposed in a free hatching stroke.

## DRAWING

by Carl O. Schniewind

Curator of Prints and Drawings, Brooklyn Museum

TO ATTEMPT to describe the various drawing processes is an embarrassing task. The drawing processes—if, indeed we can speak of "processes" at all in this connection—are so simple that it seems superfluous to want to "explain" them. Yet, paradoxical though it may seem, it is just this simplicity of technique that makes a drawing so complex, gives it all its subtility, makes it so varied, so new and surprising in appearance, completely different from artist to artist. Then, what is the material used? A sheet of paper, a bit of charcoal, red chalk, a pencil, a pen and some ink. Nothing as intricate and ingenious as a print process. The mind and the skill of the hand controlled by the mind alone count. There is no printer to hide faulty draughtsmanship with delicate intriguing tones of ink skillfully wiped over lines that had better not be there. In drawing the artist reveals, wittingly or unwittingly, his very soul—and there can be no shrinking away from these hard facts by technical trickery. A drawing is as revealing as a handwriting—in fact the two are identical in more than one respect.

Each of the various drawing processes, however, adapts itself particularly to a certain means of expression as well as to a certain temperament. The reason for this is that the material itself used in drawing having natural inherent qualities, these will always show up



NUDE (Charcoal drawing)

Georg Kolbe  
Courtesy of the Weyhe Gallery

in the drawing, no matter how much an "artist" may try to conceal them. The material imposes restrictions upon the draughtsman which cannot be overcome no matter how skillful he may be in the handling of the material. A piece of charcoal, for instance, will not stand more than a very limited amount of pressure.

It may, however, be useful to point out some of the outstanding characteristics of the drawing materials which are generally in use to-day.

**CHARCOAL** • Charcoal and red crayon are perhaps the oldest known drawing materials. They were in use back in prehistoric times by primitive man.

Twigs, mostly of willow, which are about one-quarter of an inch in diameter are cut into pieces of about five to six inches in length. They are placed in iron or clay receptacles which are hermetically sealed and then heated over a slow fire a certain length of time. Thus the organic matter is completely destroyed and nothing but pure coal and a small quantity of mineral salts remain. According to the wood used and the length of time that this wood is subjected to the treatment by heat the charcoal becomes more or less hard.

Charcoal is a soft and very brittle material. Though the stick of charcoal may be pointed, the point wears down almost at once. The line obtained with this material is broad and soft. The tone varies from a delicate light grey to a dark grey which is hardly ever really black. Charcoal does not adhere strongly to the paper, it remains on it in the form of a pulverous substance which is easily removed. The line, therefore, may be easily wiped, thus creating a grey toned surface.

From this it may be readily understood that charcoal does not lend itself to the rendering of detail. It is adapted to a broad manner, in which the subject represented is given in a general, summary way. It might be called the material for the rendering of an initial conception, with which the artist first attempts to formulate his ideas. It is a material of general research, it is never adapted to concise explanation. The results obtained are always more or less the contrary of a pen drawing.

It is just this delicate, sensitive, perishable quality of the charcoal drawing which makes it so fascinating. The idea of the artist is seen as it through a haze, it seems as furtive as the thought itself. And yet at times it may seem strong and powerful though the line never has much body.

**RED CRAYON** • Red crayon is a natural soft stone, quarried in



STUDY OF A NUDE (Red crayon drawing on greenish paper)  
Courtesy of the Weyhe Gallery

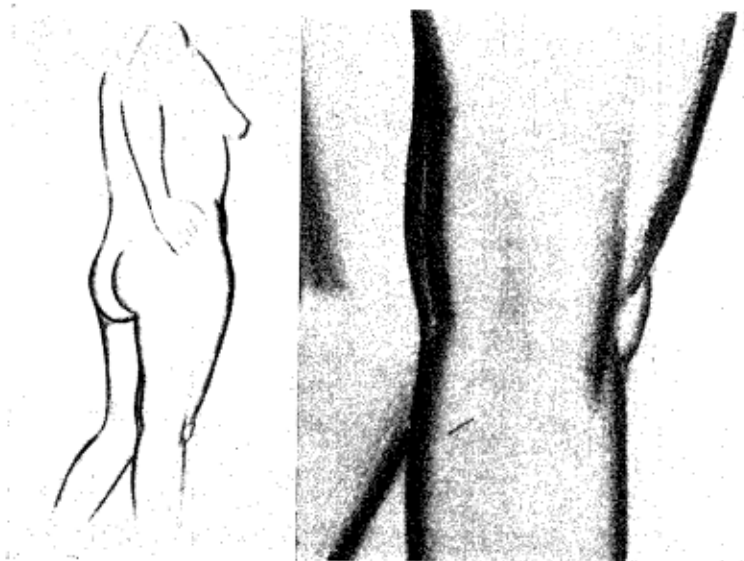
Aristide Maillol

northern Africa, Spain and Germany. Its color varies from bright red to dark red with a distinct purplish hue. It comes in various degrees of hardness. Red crayon is less brittle than charcoal, somewhat harder, but it is apt to crumble and does not adhere strongly to the paper. Thus it has much of the qualities of that material. The point wears quickly and consequently it is used in a broad manner. A red crayon line usually seems more porous and granular than a charcoal line and its vivid color gives it a warmth which charcoal does not have. It may be washed into a surface with a moistened brush so that it will seem almost like watercolor.

Both the color and the washable qualities of red crayon make it a particular favorite for the rendering of the human body. Sculptors use it a great deal for this reason. Red crayon is the first step towards color, towards the pastel.

PENCIL • The use of graphite for the purpose of writing and drawing seems to have become known during the second half of the XVIth Century. Thus its discovery as a drawing material is a comparatively late one. Graphite is pure, amorphous carbon which is found in England, Austria, Siberia and in the northeastern parts of North America. Natural graphite contains a considerable amount of impurities. It is now generally prepared artificially through heating carbon (coal) in an electric oven to a high degree. It may be obtained in various grades of hardness. It has a much greater material consistency than either charcoal or crayon. It may be readily sharpened to a fine point and the point does not wear as quickly as either of the two previously described materials. The line obtained with the pencil is never jet black, and, particularly when pressure is borne upon it, it has a metallic brilliance. It seems somewhat greasy and readily adheres to the paper. It does not crumble and is much less brittle than charcoal, consequently standing considerable pressure, though very little is needed to obtain a plainly perceivable line. Even on very smooth paper, however, it will always remain slightly granular in appearance. The more pressure one uses the more the metallic qualities of the pencil line will show up. By rubbing the line with the finger or with a wiper made of blotting paper ("estompe") the lines may be smudged until a surface tone is obtained and the line disappears entirely. This is an old academic practice to model flesh and obtain delicate tones, but the drawing loses most of its characteristic qualities through it.

The pencil line, though soft, is precise. It may seem to playfully wind its way over the paper's surface and then suddenly come to an accentuated, abrupt and decisive stop. When hard graphite is used and the pencil has a sharp point, the drawing can become coldly analytical, prying its way mercilessly into the smallest detail of the subject. It adapts itself ideally to the rendering



NUDE (Pencil drawing)  
A hard pointed pencil was used.

Eric Gill  
Courtesy of the Weyhe Gallery

of the three dimensional. The drawing is then as hard and precise as a piece of stone sculpture and always a little cold. It is this possibility of modulating a pencil drawing from playful sketchiness to solid and strict modeling that makes it an ideal drawing medium.

**SILVERPOINT** • The silverpoint was one of the principal drawing materials of the XVth Century and may be considered the immediate predecessor of the pencil drawing. The silverpoint pencil consists of a thin pointed piece of silver (silver wire) which is fastened into an appropriate holder. In order to be able to draw on the paper the drawing surface must first be given a fine, hard, rough texture so that when the point is scratched over it a small amount of silver will be retained in the form of a delicate grey line.





TREE (Silver-point drawing)

Vincent Canada  
Courtesy of the Weyhe Gallery

The paper is prepared in the following way. Finely ground white bone meal or chalk is mixed into a semi-thick mass together with starch paste. Any desired color in powder form may be mixed in with the paste. This grounding mass is then spread onto the paper in a thin coat with a brush, left to dry, and then covered with a second coat and so on until a sufficiently substantial ground is obtained. When properly done, this ground should be even and not crack. When the ground is thoroughly dry the prepared sheet is covered with another sheet of paper which is then rubbed with a dull polished instrument — formerly a boar's tooth was used — until an even and smooth surface is achieved on the grounded paper.

The line obtained in drawing on this ground is very fine and granular in structure. The color is always a dull grey, never black. In order to obtain good results the pressure used on the point must be carefully controlled. It must never be too strong, else the ground is torn open, the original white paper exposed and the silverpoint will no longer "take" on such spots. The pressure on the other hand must not be too light, else the point does not take at all. Erasures are almost impossible. Thus this technique has some very definite limitations from which the characteristics of the silverpoint result. The line is not as free as that of the pencil. It has less movement and is straighter. It is always precise and clear — almost mathematical. In time the drawing, through a slow process of oxidation of the silver, will become brown and this gives it an even softer appearance.

Silver point drawing is an almost forgotten art. But some of the principal artists of today have again taken it up and produced outstanding works of art in this medium.

**BLACK CRAYON .** • Black crayon is an artificial product, made from lampblack, charcoal or other black mineral matter which is mixed with linseed oil and wax. This is pressed firmly into moulds, thus producing a soft, unbrittle, compact material.

Jet black lines may be produced. When strong pressure is used the crayon no longer glides freely over the paper but is apt to stick and produce a greasy thick line. The lines are broad and heavy, large and impressive, but readily seem over accentuated. In time the lines, if not sprayed with fixing varnish, will become covered with a fine greyish-white film which will easily spoil the original strong effect of the drawing. This is due to a chemical change of the greasy substances of the crayon. The film may be removed by lightly rubbing over the surface with a soft cloth.



STUDY OF A CHILD (Black crayon drawing on Japan paper)

Courtesy of the Weyhe Gallery

John B. Flannagan

**PEN AND INK** • The effect obtained in a pen and ink drawing depends entirely on two things:

- (1) the ink: either India ink (jet black) or common commercial ink of various shades ranging from black to blue.
- (2) the pen: steel, quill or reed pen.

Let us first examine the various kinds of pens. Quill pens are cut from the shafts of wing feathers of swans or geese. They are cut down to the proper shapes with a sharp knife and the points are split exactly as a common steel pen. They must be re-sharpened from time to time. The pen is very soft and pliable. When a certain amount of pressure is used the pen points will separate, two parallel lines resulting. With a little less pressure a broad, almost brushlike, soft, flowing line may be obtained which, however, may



STUDY OF ISADORA DUNCAN (Steel pen with india ink)

Courtesy of the Weyhe Gallery

André Dunoyer de Segonzac

suddenly change its direction, forming sharp angles. Again the line may be as thin as the line of a steel pen.

Reed pens are cut from the stems of common reeds of various kinds and they are sharpened in the same way as the quill. This pen is very stiff and much less pliable. The lines which it achieves are thick and straight, angular and always heavy, never really graceful.

The line of the steel pen is thin, sharp, aggressive, alternatingly light, soft and graceful and then scratching and harsh, pointed and direct as a sword thrust. The same may be said of the quill and the reed pen, but the steel pen has something still more decisive. There is more rhythm perhaps in a pen stroke than in any other drawing.

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medium. The alternating upward and downward strokes cause this. The downward stroke glides easily along the surface. Then it changes sharply, abruptly into the upward stroke, the line becomes thinner, seems more hurried and nervous only to return into the heavier, smoother downward stroke again. A pen line is always even in color, the line is only thinner or broader, never blacker.

Frequently a drawing is begun in charcoal or pencil and finished in pen and ink. The former render the first conception of an idea which is then given definite outline with pen and ink. Such drawings show better than anything else the fundamental difference between charcoal or pencil and pen and ink as a medium.

As for the various kinds of ink, India ink is made from lampblack which is mixed with a thin solution of gum arabic. None other can compare with it in rich blackness. The effect is similar to that of a printer's black line. The usual commercial inks may be obtained in almost any color and shade. The results obtained greatly depend on the color used.

Drawings with the brush and ink of various shades of grey and black already approach water colors in their effect. The soft play of light and shadow on the rounded surface may be expressed with flowing ease.

Drawings may be considered the most precious documents in art. They show the entire scale of development of an idea from the initial intuition to its logical formulation. They are made without pretensions and are therefore — mostly — more honest and revealing than the finished work of art. They are fascinatingly alive and unspoiled by a desire to impress and to be representative. They experiment always, and never really attain the final goal, but show the human soul groping its way toward a goal, leaving one guessing what we are to be led to. The connoisseur will justly say to the artist: show me your drawings and I will tell you what you are.

## PRINTS

by Carl O. Schniewind

Curator of Prints and Drawings, Brooklyn Museum

THE ORIGIN of print making may be sought in the desire to produce a large number of pictures by some simple and inexpensive method. The evergrowing popular demand for the distribution of knowledge in the fourteenth and fifteenth centuries made larger and cheaper editions of writings — which at that time were still multiplied by hand — imperative. For the less erudite reader illustrations of the text were included in these manuscripts in order to make their contents more obvious. It became impossible to produce a sufficient number of copies of a text with hand drawn or painted illustrations: the process of production was too slow and too costly. A method was sought to produce as many copies of one composition as might be desired. The invention of prints was due to the necessity of finding an inexpensive solution for a problem of supply and demand.

Soon, various methods of printing pictures were developed. These methods or processes may be divided into three main groups, according to the relationship of the printing line to the surface of the block, plate or stone from which the printing is to be done.

The three main processes are called.

- A. Relief process: the line or surface which is to print is higher than the non-printing surface of the block. The block is

usually made of wood (wood-cut, wood-engraving).

- B. Intaglio process: the printing line or surface is lower than the non-printing surface of the plate. The plate is usually made of metal such as copper, steel or zinc (engraving, etching, dry-point).
- C. Planographic process: The printing line or surface is on the same level as the non-printing surface of the stone or plate (lithograph).

### I. THE WOOD-CUT: A RELIEF PROCESS

The principle is exactly the same as that of a rubber stamp: the material used being wood instead of rubber. The line or surface which is to print stands in relief, the non-printing surface having been cut away. The square wood block must have at least one even surface, the one from which the printing is to be done. The block is usually about an inch in thickness (although some artists take thin boards). The wood used is cherry, pear, beech, apple or sycamore which has been cut along the grain. These various grades of wood are more or less soft. The artist usually makes a drawing on the block of the composition he has in mind. He then proceeds to cut away to a certain depth those parts of his composition which are to remain white in the impression from the block. The tools used are knives and scoopers of various shapes and sizes.

The more or less coarse structure of wood, the fact that there is a grain which frequently shows up on impressions and that wood is brittle, all impose certain restrictions on the artist. Lines may not be cut too thin as they would easily break during the process of cutting or through the pressure used on the block in printing. The wood offers little resistance when cutting along the grain, but when



ILLUSTRATION FOR GOETHE'S WALPURGISNACHT (Woodcut)

Courtesy of the Weyhe Gallery

Ernest Barlach

one tries to cut diagonally across or vertically to the grain the resistance which the knife encounters is considerable. The result is that the wood-cut line is not an easy flowing one, not soft and graceful but angular, strict, direct and uncompromising. This quality is emphasized still more by the fact that the woodcut line is usually an even black; there are no intermittent greys, there is no softening of tonal qualities. Black and white stand in direct alternation without intervention of a half tone. This is true of the average woodcut. Some artists have more or less successfully attempted to soften the strictness of the woodcut by slightly lowering and grading the height of the printing surface thus actually achieving an



intermediate grey tone. Paul Gauguin's woodcuts are a striking example of this.

The printing of the woodcut is a comparatively simple process. The ink, a thick substance usually composed of lamp-black and linseed oil, is thinly spread on the engraved surface of the wood block with a dauber or roller. A moist sheet of paper is placed on the inked surface, the sheet covered with several layers of paper (maculature) and then through pressure the ink is transferred from the block to the surface of the paper. The pressure may be applied to the block in one of two ways: either in a press where a wooden or metal plate is screwed down upon the block or through rubbing the sheet of paper with a flat polished instrument (burnisher) or leather dauber. When the impression has been taken the paper shows indentations which are plainly visible on the back of the page.

Color woodcuts may be made by using several woodblocks. In each woodblock only those parts are cut out in relief which are to print in a certain color. By inking each woodblock with a different color and by taking an impression on the sheet of paper from first one color block, then from another, the colored woodcut is attained.

**WOOD-ENGRAVINGS** • By the use of blocks of hard wood — boxwood — which is sawed across the grain (end-grain), much finer lines may be cut with the help of an instrument used by the engraver of metal-plates (the burin). This technique was extensively used in the 19th century for book and magazine illustrations. Photo-mechanic processes have replaced it so completely that wood-engraving may today be considered an extinct art.

The relief process is the oldest print process. The earliest dated woodcut known was printed in China, A.D. 868, though there are examples of printed pictures earlier than the above example in Eastern Turkestan (before A.D. 800) and in Japan (between A.D.

764 and 770). The origin of the process in Europe is not clear. It may be traced back to textile printing, the earliest example dating from the XIV Century. The earliest woodcuts on paper date back to about 1400.

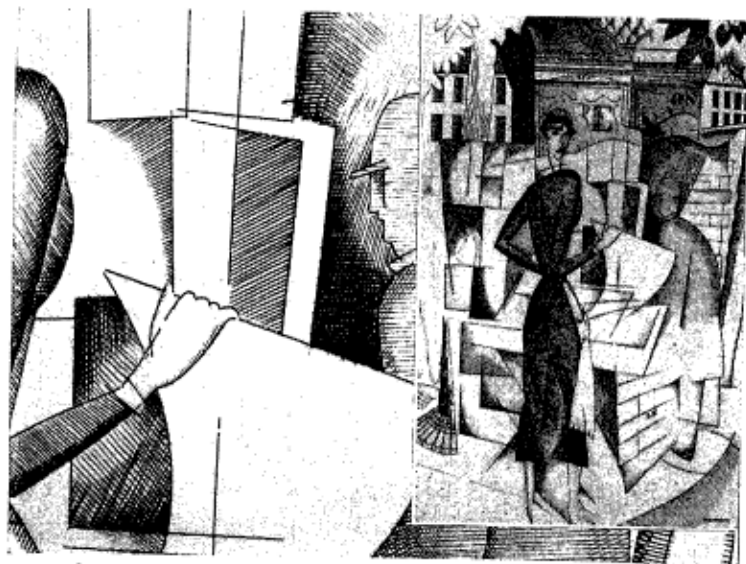
## II. INTAGLIO PROCESSES

The principle of intaglio prints is exactly the reverse of the relief process. In the relief process the printing line is higher than the non-printing surface; in intaglio the printing line is deeper, it is a groove or furrow in the non-printing surface.

These furrows or lines may be achieved in two ways: either by burrowing or scratching them into the surface of a metal plate (engraving, dry-point) or by biting the line into the plate with the help of some chemical such as an acid (etching).

**ENGRAVING** (line-engraving) • A metal plate is used, the edges of which have been bevelled in order to prevent their cutting the paper when printing. Copper is most commonly used because it is soft. Other metals employed are: steel, iron, zinc and brass. The surface of the plate must be planed evenly and polished.

The engraver uses a sharp three-cornered steel instrument called the burin or graver. By pushing this instrument along the plate — which requires quite some effort — the line is engraved on the metal. The burin removes a thin threadlike strip of the plate. By using more or less pressure the line becomes wider or narrower; by changing the angle of the burin to the surface of the plate the line may be made deeper or shallower. The edges of the line, as left by the burin, are sharp and rough. This roughness, called burr, can be cut away by a three-cornered steel knife called the scraper and the initial smoothness of the surface re-attained with a dull, polished steel instrument, the burnisher.



NEWS STAND (Line engraving)

Jean-Emile Laboureur  
Courtesy of Jean Goriany

Engraving requires considerable technical skill. The burin may easily slip and thereby cause considerable damage to the composition. A preparatory sketch of the composition which is to be engraved may be lightly scratched on the polished surface of the plate or drawn with a slightly fat crayon or chalk. Corrections are difficult and tedious. The part which is to be altered must be hammered out from the back of the plate and the surface then polished back to its original smoothness with the burnisher. This procedure will always bring about considerable damage to the parts immediately adjoining the one which is to be corrected.

Due to the fact that the hardness of the metal offers very considerable resistance to the progress of the burin the engraved line cannot evade a certain stiffness. But the line is very clear, crisp

and to the point, particularly when the burr has been removed. Every line retains its strict individuality even when lines are put closely together. Nevertheless by the use of varied pressure on the burin a wealth of tone and subtlety of line can be acquired which is hardly to be found in any other print medium.

The intaglio plate is printed as follows: a thick printer's ink, consisting of lampblack and linseed oil is thoroughly "worked up" on a glass plate with the help of a metal spatula. The ink is taken up from the plate by a dauber or tampon made of a soft piece of cloth. The ink is then thoroughly worked into the engraved lines, the plate being kept heated on a small moderately warm stove so as to keep the ink more liquid and thus to ensure its completely filling in all of the engraved lines. The surface of the plate is then wiped clean so that ink only remains in the lines themselves. More will be said about the inking of the plate in connection with etching (see below).

The printing is done in a specially constructed press. Through the turning of a large wheel a flat table is passed between two steel rollers. The plate, charged with ink, is laid face upwards on this table, covered with a sheet of moistened but not wet paper, then covered with a few more sheets of paper and finally with two or three layers of clean woolen blankets. The plate is then run through the rollers of the press under considerable pressure, leaving a plainly visible indentation in the paper (plate-mark). This pressure, incidentally, is the principle cause of wear of a plate, which is slightly flattened out through each printing. It ultimately becomes worn to the extent of the finer lines being completely obliterated. The earlier the impression therefore, the more it gives a complete record of the artist's intentions and is therefore justly considered better and finer.

In taking an impression it is important that the paper on which



BOIS DE CHAVILLE (Pure etching)

André Dunoyer de Segonzac  
Courtesy of the Weyhe Gallery

the impression is to be made should be damp as moistened paper only can absorb the ink as completely as desired.

An impression of a plate — or wood-block as a matter of fact — is always in reverse as a reflection in a mirror. Any lettering on the plate, therefore, which is to read correctly on the impression, must read from right to left on the plate.

**ETCHING** • In an etching the lines which are to be printed (in the same way as those of an engraving) are not dug into the plate with the help of a burin but they are etched into the surface. The surface of the plate is covered with a coat of wax or varnish (etching ground) which cannot be attacked by the biting fluid. This coating is usually darkened by adding lampblack, or some other color. With the help of a needle (etching needle) or other pointed instrument the drawing is scratched into the etching ground without attacking the

surface of the plate. The drawing thus appears light, the bright surface of the metal plate showing against the dark etching ground where the latter has been scratched away.

The back and edges of the plate are then completely covered with varnish, the only parts of the metal exposed being those where the drawing stands. The plate is now placed in the etching trough, a flat glass or enamel dish, and the etching fluid poured over it. The etching fluid is either nitric acid or iron chloride. The metal which is exposed to the action of the etching fluid is dissolved: the line is etched into the plate. By stopping out certain lines with etching ground or varnish and then continuing to expose the plate to the etching fluid, lines of lesser and greater depth may be obtained. The quality of the etched line may also be controlled through the temperature of the etching liquid.

When the biting has been completed the etching ground is wiped off with alcohol and the plate is ready for printing, in the same way as an engraving (see above).

Due to the fact that the etching ground offers no noticeable resistance to the needle the etched line has an ease which cannot be reached through line engraving. It flows freely over the surface of the plate, is sketchy, graceful, strong and stimulating. The etched line seems to have more individuality than the engraved one, where each line becomes important only as a part of a group of parallel strokes.

Much can be done in printing an etching to change — and if the etching is good, mostly to ruin — its effect. In order to soften the entire aspect of a plate it may be printed with surface tone, that is, in inking, instead of wiping the surface of the plate completely clear a light and even tone may be left standing, thus softening the contrast between the printed line and the paper. The ink may also be wiped over the edges of the line onto the surface of the plate

(wiping, *retroussage*) so that the line appears more or less blurred, thus obtaining additional softness. Done with restraint the beauty of the plate may be increased. Frequently, however, the artist, or a printer, may completely change the aspect of a composition which is actually on the plate (such as adding shadows and lights), a practice which may be helpful only to cover up faulty portions of the plate itself.

**DRY-POINT** • Lines may also be scratched into a plate with the help of a sharply pointed steel needle. Such plates are called dry-points. The lines resulting through this process are shallow and delicate and end in a fine point. The needle produces a line, the edges of which are rough. This roughness, called "burr" (see engraving) may be removed, but it is usually left standing in dry-points. The burr retains a small quantity of ink at the edge of the line thus giving it a velvety softness of tone. As the needle is drawn only comparatively lightly over the surface of the plate there is much less resistance than in engraving a plate. The dry-point line, therefore, shows much of the ease of the etched line, but it is much thinner, more elegant, pointed, it seems witty and clever, quick and nervous.

Dry points are printed in the same way as engravings and etchings. The lines being thin and delicate the plates wear quickly, and the burr particularly is soon lost through the pressure of the printing press.

The earliest known engravings date back to the beginning of the XVth Century. The earliest known dated engraving is a German print, dated 1446. The technique originated, in all probability, with European silversmiths who engraved ornaments on silver plates and then inked them and took impressions in order to keep a record of their compositions before they let their products out of their shops. The dry-point is almost as old as the engraving (it was used



OLD WOMAN WITH DOG (Dry-point showing clearly the burr)

Courtesy of the Weyhe Gallery

Pierre Bonnard

by the artist known as the Master of the Amsterdam Cabinet who worked about 1480) but it only came into extensive use through Rembrandt (1606-1669).

The origin of etching may be sought in the workshop of the armorer who simplified the task of decorating his steel armor plates by etching ornaments into them instead of engraving them with the burin. The earliest date, 1513, is on a plate by Urs Graf, a Swiss artist. The earliest etchings were, significantly enough, done on iron plates.

### III. LITHOGRAPHY: A PLANOGRAPHIC PROCESS

The fundamental difference between the planographic (litho-



graphic) process on one side and the relief and intaglio processes on the other side lies in the fact that, whereas in the latter two processes, the printing is due to a mere physical structure of the surface, in the former the printing is due to a difference in the chemical structure of the surface.

Although metal plates, chiefly zinc, may be used, the material which is still most generally in use for art lithography is a fine and fairly soft stone composed of carbonate of lime. This stone is mostly found near Solenhofen in Bavaria. It is cut into slabs which are, according to the size of the stone, from two to four inches in thickness. The surface is polished and a fine grain achieved through rubbing the surface with sand and water, then pumice and water.

The artist draws upon the stone with a special crayon, or with a pen or brush, using an ink which is also specially prepared for this purpose. The principle ingredients of the crayon as well as the ink is soap (or a similar fatlike substance which is soluble in water) as chemical ingredient, and lampblack as coloring, to show up the drawing on the stone. One can draw on the stone as freely as on a sheet of paper. Light spots may be placed in the midst of dark surfaces by scraping with a knife or scraper such as used in engraving to remove the burr.

When the drawing is completed the stone is then subjected to a chemical treatment with a mixture of nitric acid and gum arabic in solution. The greasy lines are not influenced by this solution, the untouched surface of the stone, however, is changed from a carbonate of lime into a nitrate of lime. It is probable that the gum arabic also enters into the chemical reaction. The nitrate of lime has the property of repelling grease. The gum arabic, which thoroughly penetrates the surface of the stone readily retains water which is of the greatest importance for the printing of the stone as will be seen later. It also prevents the grease of the crayon

or ink from spreading. Through the action of the nitric acid furthermore, the alkaline soluble soap is changed into an insoluble fat (sebacic acid). The crayon or ink is then washed from the stone with turpentine. The stone thereafter shows no more signs of a drawing, the surface is white, and the only traces of the work may be detected by looking across the surface of the stone, when the greasy parts show up slightly.

To prepare the stone for printing the surface must first be thoroughly moistened with a wet sponge. Wherever the drawing stands the fat of the crayon or ink repels the water, only the untouched surface becoming moistened. The printer's ink is then spread on the surface of the stone. Only the parts which did not take up moisture, i.e., where the drawing stands, retain the ink and thus a printable surface is achieved.

The stone is placed face upwards on the specially printed lithographic press and a sheet of moistened paper laid over it. A piece of cardboard is put over the paper and the stone pulled through the press. The lithographic press does not have rollers as the etching press but the stone passes under a well greased leather pad or scraper.

Color lithographs can be made from several stones just as color woodcuts are made from a series of woodblocks.

Instead of drawing on the stone one may draw on a special paper (transfer paper). By placing this paper on the stone and running the stone through the press the drawing is transferred on to the stone (transfer lithograph). The stone is then treated as described above. This process simplifies lithography as the very heavy stone makes work somewhat complicated. On the other hand much of the fine quality of the black lines done directly on the stone is lost through the transfer process.

The pure lithograph has qualities entirely its own, although the



PORTRAIT OF THE ARTIST (Crayon lithograph)

Diego Rivera

Courtesy of the Weyhe Gallery

impressions may at first have much of the appearance of a crayon or wash drawing. There is a softness and richness of the black tones which can be achieved in no other way and the whites are exceptionally brilliant. The line is as subtle as that of any drawing, yet is richer and has greater tonal qualities.

Lithography was invented in 1798 by Aloys Senefelder in Munich, Germany. The invention was the outcome of his prolonged experiments to find an inexpensive method of printing music, copperplate engraving being too expensive for the impoverished Senefelder.

Prints show effects which are all their own. Through the printing and the grease contained in the ink, the blacks have entirely different tonal qualities than any of the drawing materials. The restrictions imposed on the printmaker by the materials, furthermore, are of the greatest importance in producing these effects.

# BRONZE SCULPTURE\*

By Riccardo Bertelli

President, Roman Bronze Works, Inc.

THE DISCOVERY of copper alloys is lost in the prehistoric ages. Their name was Chalcos with the Greeks and Aes with the Latins. Aes Brundisium was the name of the alloy used in manufacturing famous Roman mirrors, and possibly the origin of the word "bronze" came from Brindisi (Brundisium), a city on the Adriatic coast of Italy where bronze was manufactured on a large scale. The origin of art bronzes or sculpture in bronze had its birth in the most remote days of human history, but after the invasion of the Roman Empire by the Barbarians, there was a long period of obscurity. It was in Italy during the Renaissance period that the regeneration of the bronzes of art took place, especially by the efforts of Benvenuto Cellini.

Bronzes of art are cast by two different methods: (1) the sand process, (2) the cire perdue, or lost wax process. Judging from the early specimens of bronze castings, undoubtedly the cire perdue method, or something like it, was used long before sand casting.

**SAND PROCESS** • The original model\* of the sculpture is

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\* Reprinted by courtesy of "The Encyclopaedia Britannica."

\* NOTE: This original model is generally made by the sculptor in clay on an armature, then cast in plaster. It is this plaster replica which is turned over to the foundry to be reproduced in bronze by one of the methods described in this article, though small pieces may sometimes be carved directly out of the solid metal. Clay models may also be translated into finished pieces of terra-cotta, porcelain, plaster, and other materials, or cast in various metals such as iron, aluminum, gold and silver.

J. I. H. B.



EVE AND THE APPLE (Bronze)  
Brooklyn Museum Collection.

Kai Neilson

moulded in an iron flask, with the use of very fine French sand (a composition of clay, silica and alumina). The iron flasks are strongly built frames made in two halves of such a perfect mechanical construction as to fit very closely with the aid of clamps and bolts.

The molder gently hammers the damp sand against the plaster pattern, taking care of the undercuts of the model or deep recesses, by making as many as necessary small pieces of sand in such a way as to be able to release them from the original model by taking them apart without injury either to them or to the model.

After the model is released, the packed sand model, which bears the impression of the most minute details of the original model, is recomposed and a proper sand core is built inside of it. This core is so cut that it leaves a space between itself and the piece moulds above described.

After this operation the dampness of the sand mould must be carefully eliminated by enclosing it in an oven properly built. When the mould is completely dried, the liquid bronze at about 1,900 degrees Fahrenheit is poured into the iron flasks previously recomposed and clamped together, and it will run through channels skillfully cut in the sand, going to fill the empty spaces mentioned above.

The sand is then removed, and after the bronze is cleaned with nitric acid, it will be finished and chiselled by skilful artisans.

**CIRE PERDUE, OR LOST WAX PROCESS** • The first stage of this process, after receiving the model from the artist, consists in preparing a negative made of plaster or gelatin. This is merely a coating of the outside of the model. In this negative, which shows all the details of the model in the reverse, a wax coating is applied



SELINA (Bronze)  
Brooklyn Museum Collection.  
Drawn directly on the stone.

Jacob Epstein

in a molten state with a brush until it has acquired sufficient thickness, depending on the size of the figure.

At this stage, we will have a perfect replica of the sculpture in wax, and sufficiently hard to permit handling. The artist can work on it as much as he pleases, obtaining rare results of details, which makes this process of casting invaluable. Gates and vents in the shape of wax rods are then properly attached to the wax figure.

Finally, the mould for the metal is formed by blowing or pouring inside and around the wax a semi-liquid composition, which hardens in a few minutes. This composition of silica, plaster and other chemicals can resist high temperature, and, of course, all the wax inside of it will melt away, leaving a hollow space. This operation is accomplished in large ovens, by baking the moulds over a slow fire. As soon as all the wax is surely melted away, the mould is removed from the oven and packed in foundry earth in a pit provided in the floor. The bronze is then poured from crucibles, and the molten metal will run through the gates (melted away) and fill the space left empty by the wax figure also melted away (lost wax). The figure in bronze is then removed from the silica mould and dipped in acid for a proper cleaning.

With this process, the cast bronzes require very little finishing or chiselling, and the results are far above the sand process.

The so-called "patina" of the finished bronzes is an art in itself, and the different effects of color are obtained by a large use of different chemicals.

Bronze is an alloy of from 85 to 90 percent of copper, and from 10 to 15 percent of tin, zinc and other non-ferrous metals. The alloy called United States Standard Bronze is composed of 90 percent copper, 7 percent tin and 3 percent zinc. This formula is not by any means officially approved by the United States Government, and this name was given by some bronze foundrymen only a few





NUZZLING COLT (Polished bronze)

Heinz Warnecke

years ago for their own advantage, and strange to say, it became an official word. Almost every specification generally written for contracts of art bronzes mentions the United States Standard Bronze as stipulated.

There are hundreds of other formulas of bronze, many of which contain other metals, such as lead, silver, aluminum, etc., which should not be left apart from the specifications of art bronze.

Some formulas of famous art bronzes will show the relative compositions:

Some Greek bronzes have: copper 62 percent, tin 32 percent, lead 6 percent.

Others have: copper 72 percent, tin 24 percent, lead 4.6 percent, zinc 2 percent.

The famous column Vendome in Paris has: copper 89 percent, tin 10 percent (with traces of lead, tin and silver).

The statue of Louis XIV in Paris has: copper 91 percent, tin 2 percent, zinc 6 percent, lead 1 percent.

Statue of Moliere, also in Paris has: copper 90 percent, tin 6 percent, zinc 2.5 percent, lead 1.5 percent.

The statue of Frederick the Great in Berlin has: copper 90 percent, zinc 10 percent.

There should not be any cause of alarm in judging the bronzes of art from the point of view of durability, as there are millions of specimens all over the world in an admirable condition of preservation composed of every conceivable proportion of alloy.

Not long ago some bronzes were discovered belonging to an age precedent to the Incas, with an alloy of 94 percent copper and 6 percent tin.

## STONE SCULPTURE

By John I. H. Baur

Supervisor of Education, Brooklyn Museum

THERE ARE many ways of producing sculpture in stone, ranging from the simple method of carving directly in the material by hand with the aid of a few well chosen tools, to the elaborate indirect method of modelling the statue in clay, casting it in plaster, and then reproducing this plaster version in stone by the mechanical aid of the pointing machine and the semi-mechanical help of hired carvers. As might be expected, the simple, direct method was the first one practiced, and since its use by prehistoric man, it has appeared from time to time in most of the art cycles of the ancient and modern world. It was the method of the Egyptians, the Assyrians and Babylonians, the Archaic Greeks. It was practiced by the sculptors of the Romanesque period in Europe and by certain individuals, such as Michelangelo, in the Renaissance. The interesting point, however, is that it has been revived in modern times, that it is now employed by many, if not most of the best contemporary sculptors, and that it bids fair to become the dominant technique of tomorrow. Thus there is a certain justification, aside from limitations of space, or arbitrary choice, for the fact that the present article deals almost entirely with this method.

The new popularity of direct carving is, of course, an outcome of the larger modern trend towards "functional" design, mentioned in the Foreword, since it is only by working directly in his chosen



MOTHER AND CHILD (Green Serpentine. Finished) Jose De Creeft

Note the contrast in textures, the highly polished flesh, the woman's hair done with the point, and the marks of the tooth chisel around the base.

material of stone that the sculptor can make the most of the inherent qualities of his medium. The essence of carved sculpture lies

in the fact that it is a process of taking away; the artist visualizes a certain form within the rough block before him, then chips off the outer layers slowly and with infinite care until he has revealed the outlines and surfaces of this visionary form. In the process, his original concept may, of course, be considerably altered. He may discover new possibilities in the shape of his rough block, or distinctive markings and veins below its surface, which will lead him to adapt his design more thoroughly to his material. The very slowness, too, of his technique, the patience and deliberation necessary in carving stone, may have the same result, since it permits mature deliberation and a thorough development of all the possibilities inherent in the first idea. It allows, in a word, the imagination to keep pace with the hand.

The outcome of this method, when used by an artist with ability, is to produce sculpture which not only is carefully thought out in design, but which also gives the spectator the feeling that it is really carved, hewn from the living stone, and that the individual block with its characteristic shape and markings has been respected and made an integral part of the finished piece. These latter qualities, particularly, are impossible to achieve by the indirect method. When a man makes a full-size plaster model to be translated into marble, say, via the pointing machine and the professional carver, he is exactly reversing the method described above. As his creative activity is chiefly in clay he is building up rather than hewing away, working from the inside out, rather than from the outside in. Moreover, since his design is already fixed in the plaster model, he has no way of utilizing the inherent qualities of his block of stone, no satisfactory means of altering his composition as he works to bring out the distinctive characteristics of his medium.

It is, of course, unfair to compare these two methods from one point of view. Mechanical processes are capable of producing



HEAD (Belgian Granite. Unfinished)

The marks of the point and the pick are clearly visible.

Jose De Creeft

romantic and pictorial effects in stone which are totally beyond the practical scope of direct carving, and which, in such periods as the Baroque, fully justify themselves. The point here is that, given

the modern tendency to make material, in this case stone, an expressive part of the finished work of art, there is only one method, that of direct carving, which is truly adequate.

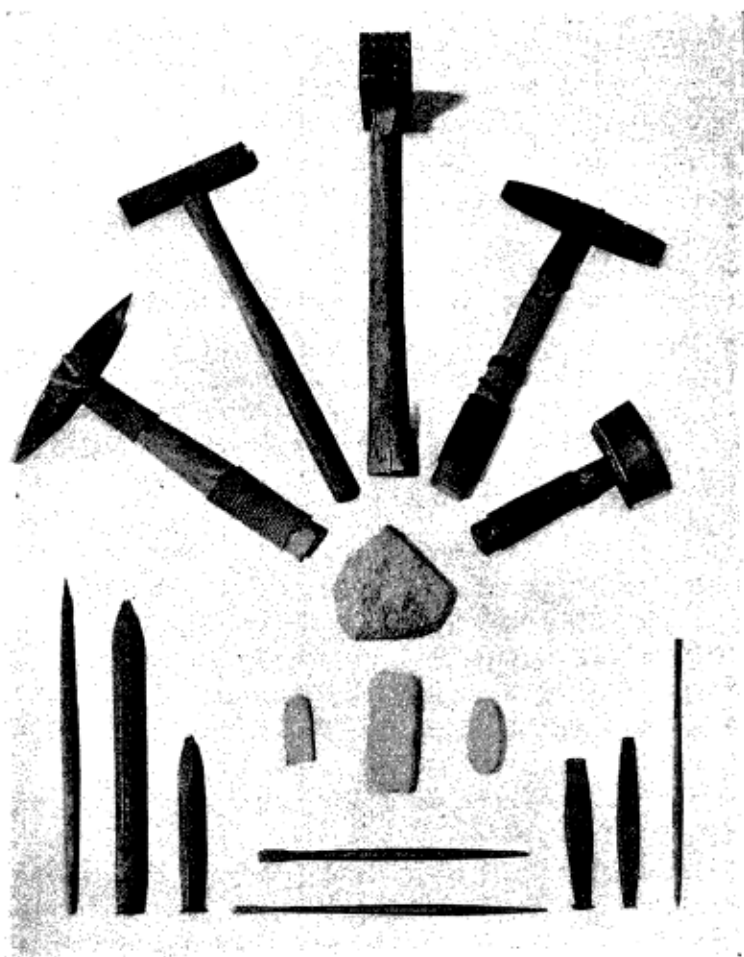
The actual technique involved is deceptively simple when one comes to describe it. My personal knowledge of the subject was purely academic until, in the course of arranging the Exhibition of Contemporary Materials and Techniques,\* I met the Spanish sculptor, Jose De Creeft, whose work formed the nucleus of the stone sculpture division there, just as it has provided the illustrative material for this article. De Creeft, is not only an outstanding exponent of the new method, but he is also interesting as one of the first to adopt it in the years just preceding the World War, and it is upon his discussion of the subject, coupled with demonstrations in his studio, that all of the following and much of the preceding is based.

Since the interest of the sculptor who practices direct carving is centered first of all in his material, he often shows a predilection for a rough block of irregular shape as his starting point. He may then let this stand untouched in his studio for one, two months, or more, gradually evolving in his mind a composition which is adapted to the form of this particular piece. It is only when he is reasonably sure of his intentions and has worked them out clearly in his mind, that he actually starts to carve, since once the cutting is under way it is difficult, if not impossible, to make any major changes. Of course, these opening steps may be just reversed, the sculptor formulating his idea first and then searching out a block which seems particularly suited to receive it. When a piece of architectural carving, or a portrait head is required, this is naturally the more usual procedure.

The first step in the actual cutting is to block out roughly the general composition in its simplest volumes, leaving the details to

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\* See Foreword.



#### THE SCULPTOR'S TOOLS

Top: hammer, bush hammers and pick. Center: polishing stones with tooth chisels below. Left: points. Right: chisels.



be done later. This roughing out is usually done with a pick or a point. The former tool resembles in miniature, the common ditch-digger's pick, though its tempered steel head is sharper at each end. The latter looks somewhat like a large nail, four or five inches in length, about a half inch in diameter, and with one bluntly pointed end. The pick, with its short handle, can be used to chip away the stone without the aid of any other tool, but where the point is employed, it is held in one hand with its sharpened end against the block while with the other it is struck with a hammer.

Another instrument often used in working out the first general volumes is the bush hammer. This consists, as its name suggests, of a hammer-like tool with a short wooden handle and a steel head generally about an inch square at the end. This end, that is, the striking face, is not flat, but covered with teeth arranged in parallel rows, which makes the instrument a comparatively rapid and effective one for wearing down the surface of the stone. The number of the teeth vary greatly, running from six up to as many as four hundred, and since they become smaller and more closely set as their number increases, it follows that the bush hammer, in its different grades, may be used at almost all stages of the carving and is capable of doing both extremely fine and very coarse work. It is particularly useful with granite and other rocks of similar hardness, but on the other hand it cannot be used extensively on more delicate materials such as the calcareous marbles and limestones. With these, its place is often taken by the tooth chisel, an instrument which resembles the ordinary chisel in all respects except that its wedge-shaped cutting edge has been serrated to form a single row of flat teeth.

By such means as the above, varied according to his individual preferences and the special requirements of material and design, the sculptor works out the general form and surfaces of his piece.

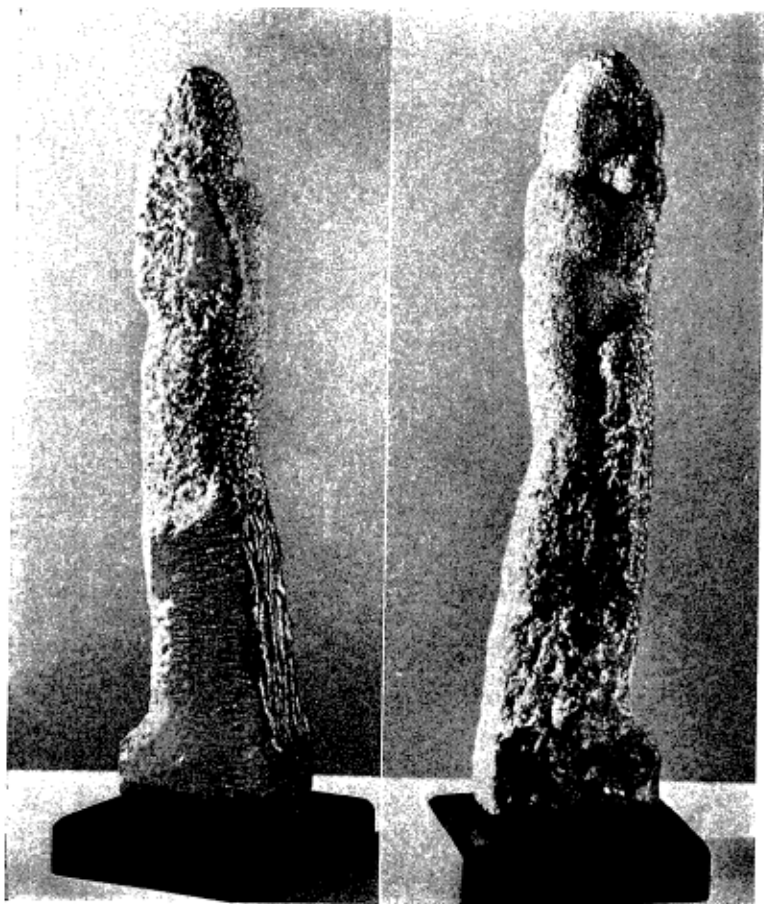
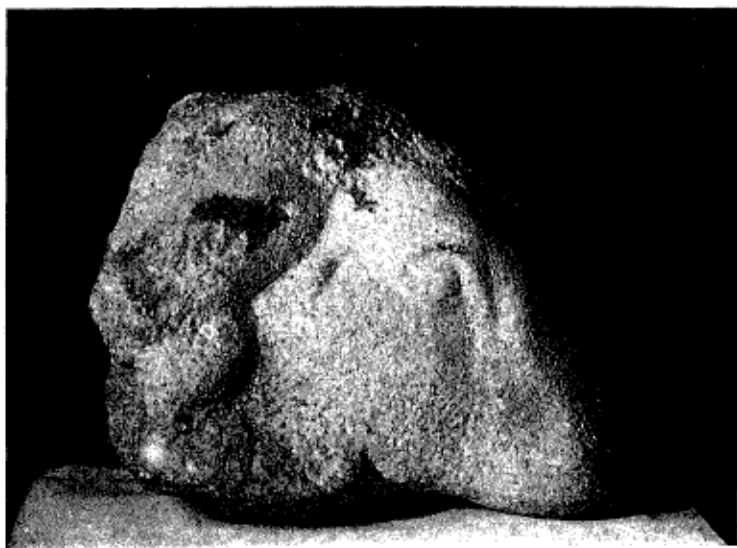


FIGURE IN ONYX (unfinished)

On the back may be seen portions of the original block. The grooves on the side were done with the point.

Jose De Creeft

The final cutting stage is done with a light hammer and flat chisels of different sizes, with which the details are carved out and the finishing touches applied. It is the chisel that cuts the thin lines



**SHEEP'S HEAD** (Connecticut Granite. Unfinished)      Jose De Creeft  
All except the chiseled eye has been done with bush hammers. The dark portions are the surface of the original stone, showing how the design has been adapted to the shape of the block.

of the eyelids, that defines the intricate structure of ears and mouth, that creates the hollows between fingers, and so on. When the chisel is laid down, the carving is generally entirely finished.

The last step consists in polishing certain parts, or all of the completed piece. If it is of granite, or one of the harder rocks, this is done first by rubbing it with polishing stones of carborundum, which is itself extremely hard as well as fine textured. When as smooth a surface as possible has been obtained in this way, a final shine can be applied by rubbing it still further with small pieces of felt dipped in emery powder and lastly in putty powder. Thus the abrasives are systematically graduated from the relatively coarse carborundum to the extremely fine putty powder, which feels to

the hand almost as soft as talcum. With the more delicate materials, such as marble, the process is essentially the same, except that sandstone in various grades and pumice stone usually replace the carborundum, while oxalic acid in crystal form often takes the place of the emery. Putty powder is again used in the final step.

But as a rule, the modern sculptor, who practices the direct method of carving, does not polish, nor even smooth off his entire piece. He often prefers to give it a variety of textures, leaving parts as rough as they came from the pick or the point, giving others the slightly granular surface of the bush hammer, and only bringing certain of his forms to a high polish. He does this for any, or all of three reasons. In the first place, it provides a certain decoration for his design with interesting contrasts which appeal to both the eye and the tactile senses. Secondly, he can use these different textures to suggest naturalistic effects, as in a portrait head where the face is often polished and the hair left rough. Lastly, and perhaps most important, this treatment emphasizes more than anything else the nature of the material with which he is dealing and forces the spectator to feel the finished work not as a transcript of plaster, nor even of nature, but as a piece of stone sculpture which is really stony.

# ARCHITECTURE

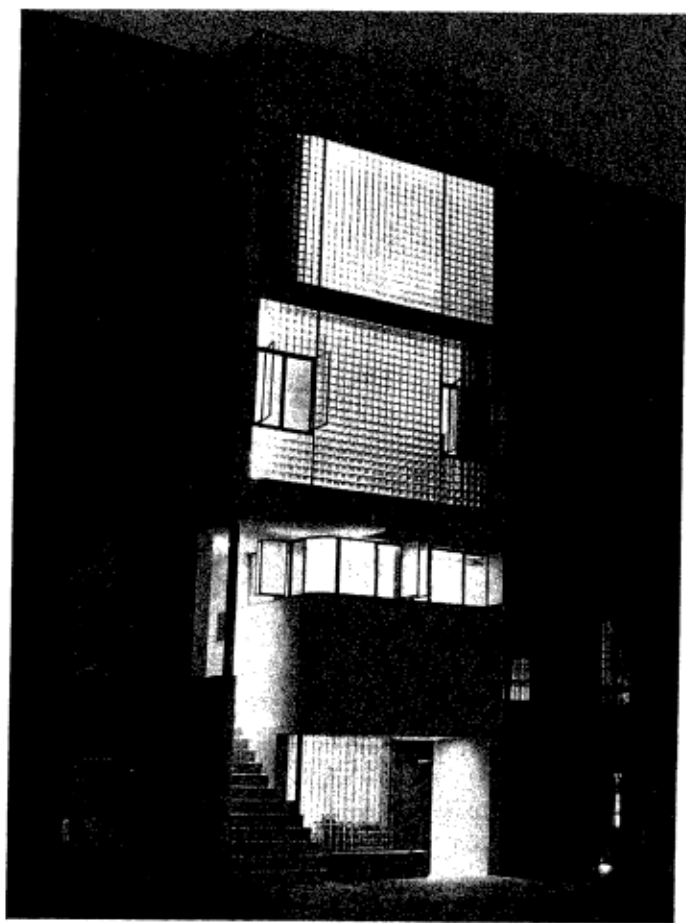
By William Lescaze

Architect, A. I. A.

ARCHITECTURE without technique is unforgivable. A violin solo without technique is bad enough, but at least it's no more than an unpleasant memory after the concerto has been played. Not so with architecture. The bad building is there for years and years.

Technique is infinite patience, learning and also love. Unless you have it in you — that patience to care for an infinite number of details, to conceive of them before you draw them up, to think about each line which you draw and give it meaning, and make it make sense — unless you have it in you — not only that love of the building and its entire masses but that love of every detail, and with, all the time, the image of the whole in your mind, the ability to control each and every detail, so that it comes out in the right scale, adding its little bit to the whole and the spirit of the whole felt within each detail — unless you have it in you, you might as well give up architecture. There is enough bad architecture as it is. Architecture without technique is worse.

But if you decide not to practise architecture, having gone as far as you have, do not turn your back on it. On the contrary, become an intelligent audience. Architects do need enlightened criticisms. Architecture can advance only as far as the public is willing to advance. This is another story.



HOUSE FOR WILLIAM LESCAZE (New York)

William Lescaze, Architect

Night view of front facade.

The dictionary says that "technique" is the manner of artistic expression or performance in relation to the formal or practical details (as distinguished from general effect, expression, sentiment, and so forth). It is also the formal and mechanical part of an art.

What are the formal or practical details which must be attended to? Basically, they are of at least three different, major kinds: (1) the requirements (a dwelling, a museum, etc., also the size and type of site); (2) the materials and the mechanical equipment (brick or marble, steel or concrete, elevators, air conditioning, etc.); (3) the drawings and specifications (documents from which a building is built). There are other details. These three are the main ones.

Therefore, three kinds of technique are needed.

1. When the city of Marinug asks an architect to come and look over its slums and tells him that they want really good low cost housing; when the Amadea Steel Company asks an architect to look over their plant and tells him what new building they have in mind; when the University of Tamitville asks an architect to come and tells him about the new building they need; when Mrs. Garnett describes to an architect the land which she has just bought and on what spot she would like to build a house — all of them expect the architect to let his pencil play on a piece of paper and after a few minutes say: "Here, look, this is what you should have."

But the architect has learned that if he were to let his pencil play at this early stage, he wouldn't be doing anything else but a "fancy" building of the picture book variety. What he must do, if he wants to create a "real" building, is to obtain first infinitely more than just that kind of vague information. When he has obtained it, he must organize it in his own mind and do a lot of thinking about it before he begins to draw a single line. What he uses as a guide in the stage of organization of information is technique of requirements. That kind of technique he acquires through exercise,

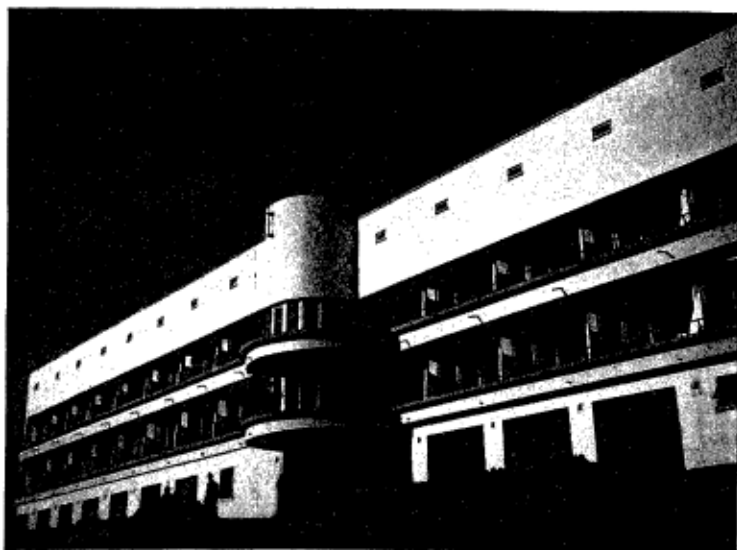


COTTAGE FOR SUMMER CAMP, Delaware, Pa., William Lescaze, Architect

through thinking, through living and experiencing life, through developing his knowledge of human occupations. With the help of that technique, he studies the activities (work or play) which are to be sheltered. They may be those of a dwelling, a factory, a shop, a courthouse, or a railroad station. They always begin and end with human beings, with human beings sitting or standing there, going from one room to another, from one floor to another, size of spaces, arrangement of spaces, circulation from street to these spaces and back to the street.

All these factors and many more must be somehow apprehended by the architect, and apprehended not only from just their physical aspect but also from their psychological effect. When the purposes





SANITORIUM, ROUMANIA

Marcel Jancu, Architect

of a building are clearly conceived, then comes the question of its fitness to the community in which it is to be planted. Again with the help of that technique of requirements, the architect obtains a sense of the community, its growth, its needs, its type and this sense acts as an indication of what particular activity might be further emphasized, which one subordinated. If the building is to be real and alive, it must be integrated into the existing background of the community. When this is achieved — or rather, at the same time that this is achieved (these processes are all simultaneous), the technique of requirements enables the architect further to understand the site, to fit the building to the site by relating the building to the trees and hills, the vistas, the sun, the winds, the roads of approach.

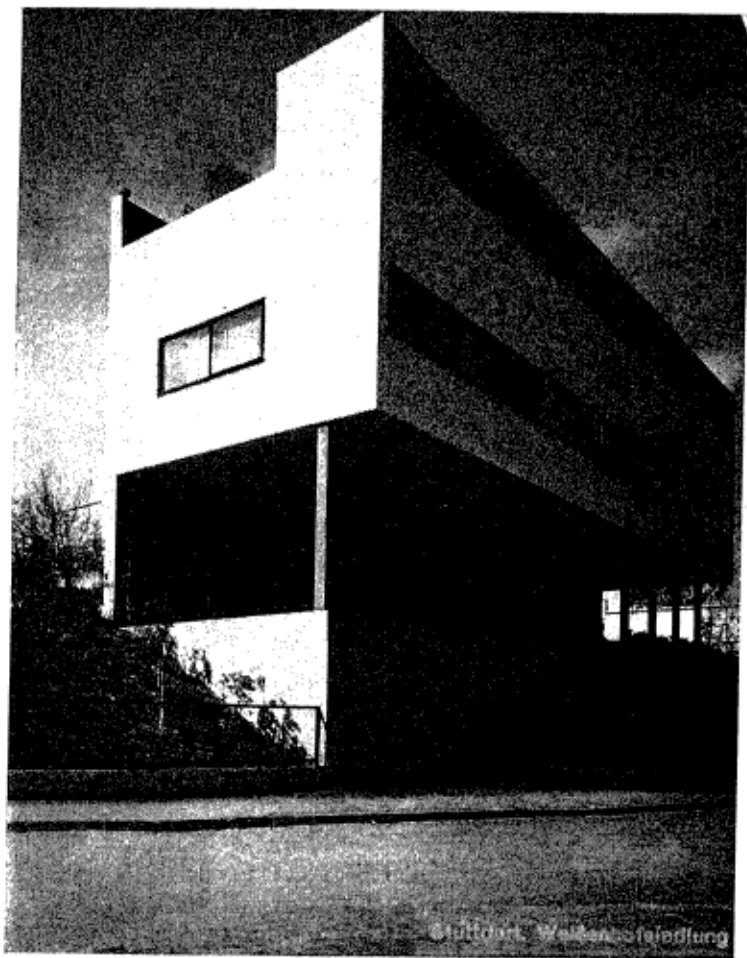
II. As one writes with words, only one thing at a time can be

said, and after that thing, another one. There is no such division in architecture. The technique which we have listed as number II, the technique of materials and equipment, has not remained at a standstill while the technique of requirements was busily accumulating information. Obviously, throughout the first process, as a result of locality or of budget, came some indications of the kind of materials, the kind of equipment which are best suited. Just as much as the requirements influence the design, so do materials and equipment influence it. All architectural forms are bound up with certain materials, the properties and the limitation of these materials.

The architect must know the properties and the limitations of the materials he uses. These he can learn and verify through laboratory tests, technical books and experience. If architects had always used materials intelligently — that is, had selected them because of their particular, definite properties, had taken advantage of these properties instead of expecting the materials to perform a service for which they were never intended — we would all have better places to live in and better places to look at.

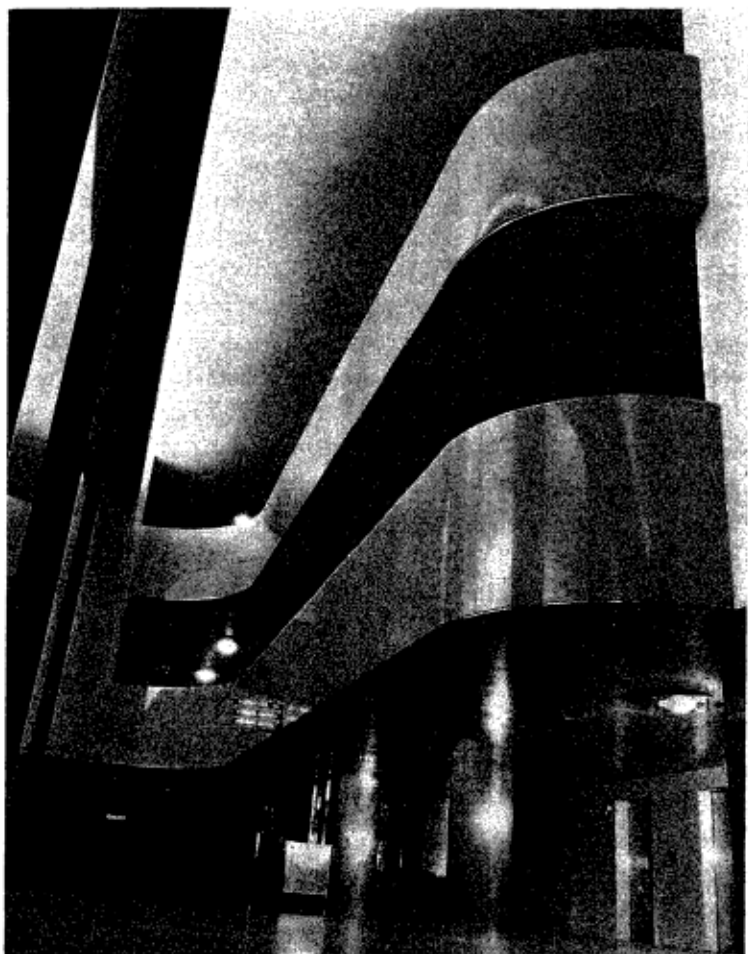
In Gothic times the material on hand was mostly stone. The arch permitted greater spans than the post and lintel construction known to the Egyptians and the Greeks. But only small sheets of glass were available then. They were leaded together to form large windows. To what extent this technique of materials affected architectural forms is obvious to everyone. The same is true of equipment. Our colonial houses needed heat which was as economical and efficient as possible. It was natural to put the fireplace in the center where it would do the most good.

Sometimes — as is the case today — labor costs and natural resources influence this technique of materials. Europe has more



HOUSE IN STUTTGART

Le Corbusier, Architect



PHILADELPHIA SAVINGS FUND SOCIETY    Howe and Lescaze, Architects  
Bank and Office Building. View of interior.

concrete buildings than America: Europe has less steel and cheaper labor.\*

The modern architect must continuously develop his technique of materials. He must have a knowledge of them which is physical, and also a feeling of and for them, which is psychological. Science brings him more new materials than ever before. Some of their properties are known, some unknown as yet, and the architect must test and verify them. And if he decides to use them, he must learn how it is best to use them, discovering in advance how they will behave in the building. Aluminum had the advantage of its light weight but didn't weather well until the "lumilite" process was recently perfected. Glass bricks with a partial vacuum let the light through and still protect from excessive heat or cold. Bakelite, Formica, Catalin, Flexboard have certain advantages, as facing materials. Rockwool, Spun-glass, Celotex, Thermax provide noise absorption and heat or cold insulation.

III. And now comes the third technique — the technique of production of the drawings and specifications. The clearer, the more precise and detailed the documents are from which the building is built, the finer the quality of workmanship of the building itself will be. And the more likely is the final cost of construction not to exceed the estimated cost. This is of great importance. An owner has a right to know exactly what the cost will be. Unfortunately, the only sure way to find out is to make a complete set of drawings and specifications and to obtain a reliable builder's bid. And this takes more time and money than is, in most cases, available.

There is no need to describe at length the technique of production of drawings. It is well mastered by a great number of Ameri-

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\* The American Library Association published in 1926 a short essay on ARCHITECTURE by Lewis Mumford, in which he outlines the relationship between materials and architectural forms. It is stimulating reading and clear thinking which not only students of architecture, but all lay persons should enjoy.

can architects. Drafting has reached a much higher standard here than perhaps anywhere else in the world. There is danger, of course, that drafting may be done at times for the sake of drafting. It's a means to an end and not an end in itself. Drafting is only one of the several techniques of architecture.

Some people have come to the conclusion that the many new materials recently developed had brought about what we call modern architecture. Yes and no. Most new materials certainly lend themselves to new types of construction. But so far, in most cases, they have been, unfortunately, used in the same old fashioned manner as former materials were used, or they have been camouflaged to look like old materials. I am reminded of the steel manufacturers who wanted us to design steel houses to look like half timbered cottages!

It seems to me that the strongest force which propels modern architecture is the growing realization by an increasing number of people, that good architecture, classic or modern, is essentially of its time, growing out of the life of its time, fully aware of the requirements of that time — making use of the materials available at that time — of the methods of construction known at that time — erecting forms with those materials according to these methods — forms beautifully appropriate to the requirements of that time.

The better our architects master their techniques — the technique of requirements, the technique of materials, the technique of production of drawings — the sooner they will be able to do what it is their business to do; namely, to readjust forms to the life of today, to the needs of human beings living today. The basic IDEA of modern architecture is precisely this much-needed readjustment to the life of today.

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